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PYRIDIUM MERCURY DISPOSAL SITE NO. 1  
VILLAGE OF HARRIMAN, ORANGE COUNTY, NEW YORK  
ADMINISTRATIVE RECORD FILE  
INDEX OF DOCUMENTS

1.0 FACTUAL INFORMATION/DATA

1.6 Sampling Plan

P. 1.0000 - Title: Sampling Report, Pyridium Mercury Disposal Site No. 1,  
1.0048 Village of Harriman, Orange County, New York, prepared by Mr.  
Eric Wilson, Project Manager, and Mr. Tom O'Neill, QC Review,  
Technical Assistance Team, Roy F. Weston, Inc., for Mr. Joseph  
Rotola, On-Scene Coordinator, Removal Action Branch, U.S.  
Environmental Protection Agency, Region II,

Date: October 1994,

Attachment 1, Results of Waste Characterization, Laboratory  
Analysis Report, prepared by Mr. Moe R. Amirsoleymoni, Quality  
Assurance Manager, Laboratory Resources, Inc., prepared for  
Ms. Smita Sumbaly, Project Manager, Roy F. Weston, Inc.,  
November 8, 1994;

Attachment 2, Results of Mercury Speciation, Letter to Dr. Eric  
Wilson, USEPA Technical Assistance Team, Roy F. Weston, Inc.,  
from Mr. Nicolas S. Bloom, Frontier Geosciences Environmental  
Research Corporation, re: Data Report for the Hg Speciation  
Identified as WC-1 (COC #T2-06869), October 25, 1994, (Attached  
Data for WC- 1 (COC #T2-06869);

Attachment 3, Figures, Figure 1, Sampling Location Map, Pyridium  
Mercury Disposal Site No. 1, Harriman, New York, October 13 -  
20, 1994; [Note: author unknown]; Figure 2, Mercury  
Concentration Map, Pyridium Mercury Disposal Site No. 1,  
Harriman, New York, October 13 - 20, 1994 [Note: author  
unknown], Not to scale due to reduced copy.

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## 1.7 Sampling Data/Data Summary Sheets/Chain of Custody Forms

- P. 1.0049 - Title: Pyridium Mercury Disposal Site No. 1, Harriman, New York,  
1.0083 Vacuum Sampling of Mobile Homes Report, prepared by Technical Assistance Team, Roy F. Weston, Inc., Federal Programs Division, for Mr. James D. Harkay, Region II Removal Action Branch, United States Environmental Protection Agency,

Date: May 1995,

Attached: Attachment A, Site Figures, Figure 1, Site Location Map, Pyridium Mercury Disposal Site No. 1, prepared by Ms. S. May, TAT PM, Roy F. Weston, Inc., Major Programs Division, for Mr. D. Harkay, EPA PM, [Note: undated]; Figure 2, Site Map, Pyridium Mercury Disposal Site No. 1, prepared by Ms. S. May, TAT PM, Roy F. Weston, Inc., Major Programs Division, for Mr. D. Harkay, EPA PM, [Note: undated]; Figure 3, Dust/Vacuum, Sample Locations, Pyridium 1, Harriman, New York, prepared by Ms. S. May, TAT PM, Roy F. Weston, Major Programs Division, for Mr. D. Harkay, EPA PM, [Note: undated];

Attachment B, NIOSH Method 6009, Documentation from NIOSH Manual of Analytical Methods, [Note: author unknown], May 15, 1989;

Attachment C, Field Data Summary Sheets and Chain of Custody Forms, Figure 1, Air Data Sheet, Sampled by Ms. Suzanne May, February 21, 1995; Figure 1, Air Data Sheet, sampled by Ms. Suzanne May, TAT, February 27, 1995, Chain of Custody Record, for Sample Analysis, signed by Ms. Suzanne May, February 27, 1995;

Attachment D, Vacuum Sampling Analytical Results, Pyridium Mercury Disposal Site No. 1, Vacuum Air Sampling Analytical Results, [Note: author and date unknown]; Laboratory Report, reviewed by Mr. Fred Usbeck, CIH, Laboratory Director, M.D.S. Laboratories, for Ms. S. May/Mr. K. Goisse, February 23, 1995;

Attachment E, ATSDR Record of Activity, ATSDR Regional Information System 2.2, Record of Activity, prepared by Mr. Steven Jones, March 27, 1995.

P. 1.0084 - Title: Sampling Report Extent of Contamination Study, Pyridium  
1.0190 Mercury Disposal Site No. 1, Village of Harriman, Orange County,  
New York, prepared by Ms. Kathy Campbell, Project Manager,  
Superfund Technical Assessment and Response Team, Roy F.  
Weston, Inc., for Mr. Eric Wilson, On-Scene Coordinator, Removal  
Action Branch, U.S. Environmental Protection Agency, Region II,

Date: June 1996,

Attached Tables: Table 1, Results of XRF Screening for Mercury  
Sampling Conducted December 6, 1994; Table 2, Results of XRF  
Analysis of NIST Standard 2709 and Calculation of MDL and MQL,  
undated;

Attached Figures: Figure 1, Mercury Concentration Map, Pyridium  
Mercury Disposal Site No. 1, October - 1994, Harriman, New York,  
undated; Figure 2, Mercury Concentration Map Pyridium Mercury  
Disposal Site No. 1, Sampling Conducted 10/94 & 12/94, Harriman,  
New York, undated; Figure 3, Extent of Contamination Map,  
Pyridium Mercury Disposal Site No. 1, Sampling conducted 10/94  
& 12/94, Harriman, New York, undated;

Appendix A, Results of Soil Sampling - October 1994, Table A1,  
XRF Screening Location Descriptions, Pyridium Mercury Disposal  
Site No. 1, - Harriman, NY, October, 1994; Table A2, Mercury  
Concentration by Mercury Cold Vapor Atomic Absorption Pyridium  
Mercury Disposal Site No. 1 - Harriman NY, October 1994;

Appendix B, Soil Sampling SOP #2012, 2.0 Soil Sampling, #2012,  
undated;

Appendix C, Borehole Log, Boring # B - 70, 12/6/94; B - 130,  
12/6/94; B-160, 12/6/94; B - B 12/6/94; D -130, 12/6/94; D - 190,  
12/6/94; D - D, 12/6/94; E - 90, 12/6/94; E - 210, 12/6/94; G - 70,  
12/6/94; G - 170, 12/6/94;

Appendix D, USEPA ERT/REAC Spectrace 9000 XRF SOP,  
Spectrace 9000 Field Portable X-Ray Fluorescence Operating  
Procedure, USEPA - SOP #1713, undated;

Appendix E, XRF Data, Data, May 27, 1994;

Appendix F, XRF Log Entries, Log, December 6, 1994 - December  
7, 1994;

Appendix G, Soil Boring Cross Sections: Figure 1, Cross Section, Sample Line B, Pyridium Mercury Disposal Site No. 1, Harriman, New York, December 1994, prepared by Mr. J. Hampton Jr., Federal Programs Division, Roy F. Weston, Inc., for Mr. E. Wilson, Task Monitor, US EPA Removal Action Branch, undated; Figure 2, Cross Section, Sample Line D, Pyridium Mercury Disposal Site No. 1, Harriman, New York, December 1994, prepared by Mr. J. Hampton Jr., Federal Programs Division, Roy F. Weston, Inc., for Mr. E. Wilson, Task Monitor, US EPA Removal Action Branch, undated; Figure 3, Cross Section, Sample Line E, Pyridium Mercury Disposal Site No. 1, Harriman, New York, December 1994, prepared by Mr. J. Hampton Jr., Federal Programs Division, Roy F. Weston, Inc., for Mr. E. Wilson, Task Monitor, US EPA Removal Action Branch, undated; Figure 4, Cross Section, Sample Line G, Pyridium Mercury Disposal Site No. 1, Harriman, New York, December 1994, prepared by Mr. J. Hampton Jr., Federal Programs Division, Roy F. Weston, Inc., for Mr. E. Wilson, Task Monitor, US EPA Removal Action Branch, undated;

Appendix H, Calculations of the Quantity of Contaminated Soil, undated;

Appendix I, NIST Certificate of Analysis for Standard Reference Materials 2709, National Institute of Standards & Technology, Certificate of Analysis, Standard Reference Material 2709, San Joaquin Soil, Baseline Trace Element Concentrations, prepared by Mr. William P. Reed, Chief, Standard Reference Materials Program, October 30, 1992.

## **2.0 DECISION DOCUMENTS**

### **2.2 Action Memoranda & Amendments**

- P. 2.0001 - Title: Documentation of Verbal Authorization for a Removal Action  
2.0019 at Pyridium Mercury Disposal Site No. 1, Village of Harriman, Orange County, New York, to Ms. Kathleen C. Callahan, Director, Emergency and Remedial Response Division, from Mr. James D. Harkay, On-Scene Coordinator, Removal Action Branch Section B, United States Environmental Protection Agency, Region II, through Mr. Richard C. Salkie, Associate Director, Removal and Emergency Preparedness Programs,

Date: February 27, 1996,



Attached: Appendix A, Letter to Ms. Kathleen C. Callahan, Director, Emergency & Remedial Response Division, United States Environmental Protection Agency, Region II, from Mr. Michael J. O'Toole, Jr., Director, Div. of Hazardous Waste Remediation, re: Pyridium Mercury Disposal Site, Harriman (V) Orange County, N.Y., September 29, 1994;

Letter to Mr. Michael J. O'Toole, P.E., Director, Division of Hazardous Waste Remediation, NYS Department of Environmental Conservation, from Mr. G. Anders Carlson, Ph.D., Director, Bureau of Environmental Exposure Investigation, State of New York Department of Health, re: Mitigating Potential Exposures, Pyridium Mercury Disposal Site, NYSDOH Site #336821N, (V) Harriman, Orange County, September 9, 1994;

Appendix B, Figure I, Site Location Map, Pyridium Mercury Disposal Site No. 1, prepared by Ms. S. May, TAT PM, Weston, Roy F. Weston, Inc., Major Programs Division, for Mr. D. Harkay, EPA PM, [Note: date unknown];

Figure 2, Site Map, Pyridium Mercury Disposal Site No. 1, prepared by Ms. S. May, TAT PM, Weston, Roy F. Weston, Inc., Major Programs Division, for Mr. D. Harkay, EPA PM, [Note: date unknown]);

Appendix C, Additional documentation relating to this section can be found in the following: Section: Administrative Record, Section 5.4, Document Date: August 28, 1985, Document Title: Health Consultation, Pyridium Mercury Disposal Site #1, Orange County, Harriman, New York, CERCLIS No. NY0000856237.

## **2.3 Documentation of State Involvement**

- P. 2.0020 - Letter to Ms. Kathleen C. Callahan, Director, Emergency &  
2.0021 Remedial Response Division, United States Environmental  
Protection Agency, Region II, from Mr. Michael J. O'Toole, Jr.,  
Director, Div. of Hazardous Waste Remediation, New York State  
Department of Environmental Protection, re: Pyridium Mercury  
Disposal Site, Harriman (V) Orange County, N.Y., September 29,  
1994.

### 3.0 PUBLIC PARTICIPATION

#### 3.6 Press Coverage

- P. 3.0001 Newspaper article: "New year will bring new start, Toxic site residents prepare to relocate," by Ms. Amy Beth Terdiman, The Times Herald Record, December 31, 1994.
- P. 3.0002 Newspaper article: "Experts expand soil tests, Fill at second Harriman site analyzed," by Ms. Amy Beth Terdiman, Staff Writer, The Times Herald Record, October 25, 1994.
- P. 3.0003 Newspaper article: "Love Canal lessons shared," by Ms. Amy Beth Terdiman, The Times Herald Record, October, 18, 1994.
- P. 3.0004 Newspaper article: "Harriman soil tests set, Village residents fear spread of contamination," by Ms. Amy Beth Terdiman, Staff Writer, The Times Herald Record, October 14, 1994.
- P. 3.0005 Newspaper article: "Passing a test," photo, by Mr. Jeff Goulding, The Times Herald Record, October 14, 1994.
- P. 3.0006 - Newspaper article: "EPA workers scour trailer park pollution, EPA  
3.0007 searches for extent of contamination," by Ms. Amy Beth Terdiman, Staff Writer, The Times Herald Record, October 13, 1994.
- P. 3.0008 Newspaper article: "Mercury deposit remains a mystery," The Times Herald Record, October 12, 1994, (Note: author unknown).
- P. 3.0009 Newspaper article: "Village water mercury free, mayor tells residents," by Ms. Amy Beth Terdiman, Staff Writer, The Times Herald Record, October 12, 1994.
- P. 3.0010 Newspaper article: "Memory losses alarming, Contractor fears mercury contact," by Mr. Christopher Mele, Staff Writer, The Times Herald Record, October 11, 1994.
- P. 3.0011 - Newspaper article: "A poison sewn into the soil, Mercury  
3.0012 compound found in trailer park," by Mr. Christopher Mele, Staff Writer, The Times Herald Record, October 8, 1994.

## **4.0 ENFORCEMENT DOCUMENTS**

### **4.4 Administrative Orders/Consent Decrees**

- P. 4.0001 - Title: Administrative Agreement and Action Pursuant to  
4.0025 . Section 106 (a) of the Comprehensive Environmental Response,  
Compensation, and Liability Act, as amended, 42 U.S.C. § 9606  
(a), In the Matter of The Pyridium Disposal Site, Nepera, Inc., Index  
Number, II-CERCLA-95-0203, Issued by United States  
Environmental Protection Agency, Region II,

Date: November 28, 1994,

Attached: Exhibit A, Relocation Work Plan, Pyridium Site,  
Harriman, NY, [Note: author and date unknown]; Site map of  
NYSDEC Final Lab Results, Mercury Trailer Site, NYSDOH site  
#336821N, (V) Harriman, Orange County, prepared by Mr. Mark E.  
VanValkenburg, NYSDOH, August 9, 1994.

## **5.0 OTHER AGENCY DOCUMENTATION**

### **5.4 ATSDR Health Assessments/Other Health Assessments**

- P. 5.0001 - Report: Health Consultation, Pyridium Mercury Disposal Site #1,  
5.0026 Orange County, Harriman, New York, CERCLIS No.  
NY0000856237, prepared by New York State Department of  
Health, Under Cooperative Agreement With U.S. Department of  
Health & Human Services, Public Health Service, Agency for Toxic  
Substances and Disease Registry,

Date: August 28, 1995,

Attached: Appendix A Figures, Figure 1, Site Location, Harriman,  
New York, [Note: author and date unknown]; Figure 2, Site map,  
Mercury Trailer Site, (V) Harriman, Orange County, prepared by  
Mr. Mark E. VanValkenburg, NYSDOH, August 9, 1994; Figure 2B,  
Location Map, Pyridium Mercury Disposal Site No.1, Harriman,  
New York, [Note: author and date unknown];

Appendix B Tables, Table 1, Soil Comparison Values For  
Residential Exposure To Inorganic Mercury, [Note: author and date  
unknown];

Appendix C Public Health Hazard Categories, Public Health Assessment Guidance Manual, prepared by U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry, March, 1992;

Appendix D Response to Public Comments, Pyridium Mercury Disposal Site #1, Response to Public Comments, [Note: author and date unknown]).

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SAMPLING REPORT  
PYRIDIUM MERCURY DISPOSAL SITE NO. 1

VILLAGE OF HARRIMAN  
ORANGE COUNTY, NEW YORK

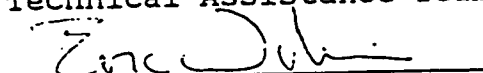
OCTOBER 1994

Prepared for:

U.S. Environmental Protection Agency  
Region II Removal Action Branch  
Joseph Rotola, On-Scene Coordinator

Prepared by:

Roy F. Weston, Inc.  
Technical Assistance Team



Eric Wilson  
Project Manager



Tom O'Neill  
QC Review

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## 1. INTRODUCTION

### 1.1 Site Background

The Pyridium Mercury Disposal Site is a mobile home park located on the south corner of the intersection of State Route 17M and Harriman Heights Road (County Route 71) in the Village of Harriman, Orange County, New York.

A white clay-like material was discovered at the site during an investigation at the adjacent transmission shop. Samples collected by the New York State Department of Environmental Conservation (NYSDEC) and New York State Department of Health (NYSDOH) were found to contain mercury at concentrations ranging from less than 1 mg/kg to 653 mg/kg.

Mercury contamination at the site is suspected to be the result of the use of a mercury-contaminated industrial waste to fill a wetland area on which the mobile home park was built.

### 1.2 Sampling Objective

The U.S. Environmental Protection Agency (EPA) Region II On-Scene Coordinator (OSC) tasked the Roy F. Weston, Inc. Technical Assistance Team (TAT) with conducting a study to determine the nature and extent of contamination in surface soils at the site.

## 2. METHODOLOGY

### 2.1 Sampling Summary

All sampling was conducted between October 13 and 20, 1994. Surface soils were screened in place using an X-Ray Fluorescence Analyzer (XRF) to delineate the extent of contamination. Samples were collected, at a minimum of 10% of the screening locations, for laboratory analysis to confirm the XRF results.

A waste composite sample was collected on October 20, 1994 and analyzed for target compound list (TCL) parameters, target analyte list (TAL) parameters, toxicity by the toxicity characteristic leachate procedure (TCLP), and for mercury speciation.

### 2.2 XRF Field Screening for Metals

Between October 13 and 15, 1994, 54 surface soil locations were screened with the Spectrace 9000 XRF. Screening locations are located at 20 foot intervals along eight transects. These transects were set up parallel to the trailers. Figure I depicts screening and sampling locations.

The screening locations were prepared as follows: If covered with grass, the turf was cut and removed to reveal the underlying soils. A hole was advanced to a depth of six inches or until waste was encountered. The waste or soil at the bottom of the hole was then analyzed in place using the XRF. If the sample was found to be saturated with water it was collected, placed in a clean sample jar, dried using a microwave oven and placed in a plastic cup for XRF analysis.

Source measuring times used for XRF analysis were 200 seconds for the Cadmium 109 (Cd109), 60 seconds for Iron 55 (Fe55) and 60 seconds for Americium 241 (Am241). All locations were analyzed three times, the instrument probe was moved, within the hole, between each run. The results of the three runs were averaged to obtain the final results.

Results for all 26 elements analyzed were stored in the instrument's internal memory; this data was downloaded to a computer data file for further processing. As a backup mercury and calcium results were recorded in the site log book.

### **2.3 Sample Collection for Total Mercury Analysis**

One sediment sample (SD-1) was collected at the outfall of a drainage culvert located northeast of the paved area between the Marina Pizza Restaurant and the Monroe/Woodbury Health and Fitness Center. This sample was collected from 0 to 3 inches below the sediment surface, below the water line, on the side of drainage channel, 20 feet downstream of the culvert.

Soil samples were collected at 10% of the XRF screening locations to verify the accuracy of XRF results.

All soil/sediment samples were collected from 0 to 6" below the ground surface, unless otherwise noted. All samples were collected using disposable plastic scoops, and placed into precleaned sample-jars, capped and labeled.

Samples to be analyzed for total mercury were delivered to Chemtech, Inc., Englewood, New Jersey. Sample chain of custody procedures were followed for all samples.

### **2.4 Sample Collection for Waste Characterization and Mercury Speciation**

One waste composite sample (WC-1) was collected on October 20, 1994 for waste characterization and mercury speciation. This composite sample was formed from mixing equal parts from waste samples collected from the four locations described in Table I.

Table I  
Sampling Locations for Waste Composite Samples (WC - 1)

SAMPLE ID	LOCATION	DESCRIPTION
C55	C55	White clay-like material collected at approximately 6 inches below ground surface in Hedges garden.
Test 1	150	White clay-like material collected 0-6 inches below ground surface in sink hole.
Test 2	F190	White clay-like material collected from exposed surface waste.
G150	G150	White clay-like material collected 0-6 inches below ground surface in sink hole.

A portion of this sample was delivered to Lab Resources Teterboro, New Jersey, for waste characterization. This sample was analyzed for TCL and TAL parameters, and toxicity by the TCLP.

A portion of this sample was delivered to Frontier Geosciences, Seattle, Washington for mercury speciation. This sample was analyzed for total mercury [Hg(total)], monomethyl mercury (MMHg), dimethyl mercury (DMHg), elemental mercury [Hg(0)] and ionically bonded mercury detected as mercury +2 ion [Hg(II)].

### 3.0 RESULTS

#### 3.1 XRF Results

The results of XRF analysis indicate that the range of mercury concentration in surface soil at the site varies from less than the instrument minimum detection limit (MDL) to a high of 244 mg/kg. The instrument MDL and minimum quantitation limit were calculated to be 92 and 306 mg/kg, respectively. The results of XRF analysis and sample descriptions are presented in Table II.

Table II - XRF Screening Location Descriptions

MPLE ID	MERCURY CONC. (mg/kg)	DESCRIPTION
A30	<90	Brown coarse soil & gravel fill 0-6".
A50	<90	Brown coarse soil fill 0-6".
A70	<90	Brown organic topsoil 0-6".
A90	<90	Brown organic topsoil 0-6".
A110	<90	Brown organic topsoil 0-6".
A130	<90	Brown organic topsoil 0-6".
A150	<90	Brown organic topsoil 0-6".
B30	<90	Brown coarse soil & gravel fill 0-6".
B50	114B	White clay-like material visible at 3".
B70	239B	White clay-like material visible at 3".
B90	<90	Brown organic silt 0-6".
B110	<90	Brown organic silt and sand fill 0-6".
B130	<90	Brown organic silt and sand fill 0-6".
B155	<90	Brown organic silt 0-6".
C30	<90	Brown coarse soil and gravel fill 0-6".
C55	208B	White clay-like material visible at 6".
C70	19B	White clay-like material mixed with brown organic silt 0-6".
C90	<90	White clay-like material mixed with brown organic silt 0-6".
C110	<90	White clay-like material at 6".
C130	<90	White clay-like material at 6".
C130R	<90	White clay-like material at 6".
C150	<90	White clay-like material at 6".

Table II - XRF Screening Location Descriptions (continued)

AMPLE ID	MERCURY CONC. (mg/kg)	DESCRIPTION
C170	<90	Brown organic silt and sand 0-6".
D30	<90	Brown coarse soil and gravel fill 0-6".
D50	<90	Brown organic silt mixed with trace quantities of white clay-like material 0-6".
D70	<90	Brown organic silt mixed with white clay-like material 0-6".
D90	<90	White clay-like material mixed with brown organic silt 0-6".
D110	227B	White clay-like material mixed with brown organic silt 0-6".
D130	<90	Brown organic silt and fine sand fill 0-6".
D150	<90	Brown organic silt 0-6".
D170	<90	Brown organic silt mixed with debris 0-6".
D190	<90	Brown organic silt 0-6".
E30	<90	Brown coarse soil and gravel 0-6".
E50	<90	Brown organic silt and gravel 0-6".
E70	<90	Brown organic silt and fine sand mixed with white clay-like material 0-6".
E90	<90	Brown organic silt and fine sand mixed with white clay-like material 0-6".
E110	241B	Brown organic silt mixed with white clay-like material 0-6".
E130	<90	Brown organic silt mixed with woodchips, gravel and some black ash 0-6".

Table II - XRF Screening Location Descriptions (continued)

SAMPLE ID	MERCURY CONC. (mg/kg)	DESCRIPTION
E150	244B	Surface brown organic silt mixed with woodchips and gravel. White clay-like material present below surface.
E170	151B	Brown organic silt. White clay-like material present at surface.
E190	148B	Brown organic silt mixed with woodchips. White clay-like material present at 3".
E210	101B	Brown organic silt mixed with woodchips. White clay-like material present at 3".
E215	<90	Brown organic silt 0-6". On slope of hill.
F130	94B	White clay-like material present just below turf.
F210	<90	Brown organic silt 0-6".
G70	<90	Brown organic silt 0-6". Wetland area.
G90	<90	Brown organic silt 0-6". Wetland area.
G110	<90	Brown organic silt 0-6". Wetland area.
G130A	<90	Brown organic silt and fine sand mixed with trace light-colored material 0-6". Purposefully concentrated for analysis.
G130B	120B	Organic silt. Analysis of surface soils.
G150	95B	White clay-like material taken from sinkhole 0-12".
G170	128B	White clay-like material present at 6".
G190	134B	White clay-like material present at 6".
G210	<90	Brown organic silt 0-6". Analysis of surface soils.

Table II - XRF Screening Location Descriptions (continued)

SAMPLE ID	MERCURY CONC. (mg/kg)	DESCRIPTION
H30	<90	Brown organic silt 0-6". Sample dried and analyzed in cup.
H100	<90	Brown organic silt 0-6".
H130	<90	Brown organic silt 0-6".
H150	<90	Brown organic silt 0-6".
H170	<90	Brown organic silt 0-6".
H190	<90	Brown organic silt 0-6".
Test 1	<90	White clay-like material taken from sink hole at D150.
Test 2	128B	White clay-like material found at ground surface at F190.
DP-1	<90	Brown organic silt and gravel 0-3". Sample collected in drainage path below water line, dried and analyzed in cup.
DP-2	<90	Brown organic silt and gravel 0-3". Sample collected in dry section of intermittent drainage path, dried and analyzed in cup.

Note: B - Analyte detected above method detection limit of 92 mg/kg and less than method quantitation limit of 306 mg/kg. Concentrations are estimated.

### 3.2 Total Mercury Results

The results of total mercury analysis of surface soil samples are presented in Table III.

Table III  
Mercury Concentration by Mercury Cold Vapor Atomic Absorption

Sample ID	Mercury Concentration (ug/kg)
C130-R	169.0
D30	8.80
D90	108.0
D110	427.0
G130-B	38.9
H30	13.7
H100	15.9
H130	3.74
SD-1	0.643
Test-1	657.0
Test-2	115.0

### 3.3 Results of Waste Characterization

The results of analysis of sample WC-1 for TCL and TAL parameters, and toxicity by TCLP are included as Attachment 1.

### 3.4 Results of Mercury Speciation

The results of mercury speciation of sample WC-1 are included as Attachment 2.



## 4.0 DISCUSSION OF RESULTS

4.1 Data Comparison Between XRF and Atomic Absorption Results for Mercury

Ten samples were analyzed by the Spectrace 9000 XRF and mercury cold vapor atomic absorption (AA), these results are presented in Table IV.

Table IV  
Comparison of XRF and AA Results for Mercury

Sample ID	Mercury Conc. by XRF (mg/kg)	Mercury Conc. by AA (mg/kg)
C130-R	<90	169.0
D30	<90	8.8
D90	<90	108.0
D110	228	427.0
G130-B	<120	38.9
H30	<90	13.7
H100	<90	15.9
H130	<90	3.74
Test-1	<90	657.0
Test-2	128	115.0

A regression analysis was performed for each data pair to determine if a correlation exists between XRF and AA results. The results did not correlate well, the correlation factor for the ( $r^2$ ) test was -0.18. The U.S. EPA Environmental Response Team/Response Engineering and Analytical Contract Standard Operating Procedures for Spectrace 9000 Field Portable X-Ray Fluorescence recommends a correlation factor ( $r^2$ ) of 0.7 or greater for QA2 data quality objectives.

The data from XRF screening of surface soils conducted between October 13 and 15, 1994, should be considered to meet QA1 quality assurance requirements. According to EPA Quality Assurance/Quality Control Guidance for Removal Activities QA1 data is sufficient for preliminary assessment of types and levels of pollutants. No conclusion can be drawn from this data regarding the existence of mercury at

concentrations less than the XRF minimum detector limit of 92 mg/kg. XRF data indicating mercury concentration greater than the minimum detection limit of 92 mg/kg and less than the minimum quantitation limit of 306 mg/kg is sufficient for a determination of the existence of mercury, however, the data should not be considered quantitatively accurate.

The AA results meet EPA QA2 quality assurance requirements. Although no guarantees can be made regarding the accuracy of data even if it passed all quality control tests, the AA data is considered to have a higher confidence level than the XRF data which meets the less stringent requirements of EPA QA1. As such the AA data supersedes XRF data for any given sampling location.

#### 4.2 Delineation of Mercury Contamination

One of the objectives of this sampling program was to delineate the horizontal extent of mercury contamination in surface soils. For this sampling event, surface soils were considered to be the first 6 inches of soil below the existing ground surface. It should be noted that no attempt was made to determine the vertical extent of contamination or to document contamination at depths greater than 6 inches below the ground surface. As a result, no conclusions can be drawn regarding the existence of mercury contamination at depths greater than 6 inches.

A map showing the mercury concentration at each sampling location is included as Figure II. Based on analytical results and visual observations, the area of waste disposal at this site appears to be continuous and limited to the property described as District 40 Section 103 Block 5 Lot 2 on the tax maps for Orange County.

Low level mercury contamination was noted in the wetlands east of the waste disposal area. Samples H30, H100 and G130 were found to contain mercury at concentrations of 13.7, 15.9 and 38.9 mg/kg respectively. No visible waste was observed at these sample locations, indicating that contaminants have migrated from the waste disposal area to the adjacent wetlands.

Sediment sample SD-1, collected at the outfall of the drainage culvert located on the northeast side of Route 17M (opposite the site), was found to contain mercury at a concentration of 0.643 mg/kg; this is greater than the background concentration range for mercury in uncontaminated soil for the Albany, New York area (Reference 1). Based on this data, it appears that contaminants have migrated via the surface water route to the sediments of the creek which originates at the outfall of the drainage culvert.

#### 4.3 Waste Characterization

One waste composite sample (WC-1) was collected on October 20, 1994, and analyzed for TAL, TCL and toxicity by TCLP.

All TCLP results are below regulatory limits. Therefore, the waste does not exhibit the characteristic of toxicity as defined by the Resource Conservation and Recovery Act.

The results of TAL analysis indicate that calcium and mercury are present in elevated concentrations. Mercury was detected at an estimated concentration of 130 mg/kg; calcium was detected at a concentration of 170,000 mg/kg. All other metals are below or within the background concentration range for metals in uncontaminated soil for the Albany New York area (Reference 1).

The following organic compounds were detected in the sample: methylene chloride, pyrene, phenanthrene, fluoranthene, benzo(k)fluoranthene, benzo(b)fluoranthene, benzo(a)anthracene, chrysene and benzo(a)pyrene. The concentration of these compounds in the waste are below the NYSDEC recommended soil cleanup objectives (Reference 2).

These data meet EPA QA1 quality assurance requirements and are useable as qualified.

#### 4.4 Speciation of Mercury

The results of the speciation of mercury conducted by Frontier Geosciences on waste composite sample (WC-1) indicate that the sample contained no significant quantities of elemental mercury, monomethyl mercury or dimethyl mercury. The sample dissolved completely in a 4N HCl leach. The mercury +2 ion concentration in the leachate was essentially the same as the total mercury concentration in the sample. Based on these results, the laboratory concluded that the sample is a chemical substrate contaminated with a mercuric or mercurous salt.

These data meet EPA QA2 quality assurance requirements and are useable as reported.

## 5.0 CONCLUSIONS

1. The white clay-like material found at the site contains elevated concentrations of mercury and calcium. The mercury is in the form of an inorganic mercuric or mercurous salt.
2. Waste disposal at this site appears to be limited to the property described as District 40, Section 103, Block 5, Lot 2 on the tax maps of Orange County.
3. Mercury contamination has been identified in surface soils in the wetlands located east of the disposal area and in sediments of the creek located northeast of State Route 17M directly across from the site.

REFERENCES

1. Shacklette, Hansford T. and Josephine G. Boerngen. 1984. Elemental Concentrations in Soils and Other Surficial Materials in the Conterminous United States. U.S. Geological Survey Professional Paper 574-D Vol 713-715A.
2. Michael J. O'Toole, Jr., Director, Division of Hazardous Waste Remediation, NYSDEC. 1992. Division Technical and Administrative Guidance Memorandum: Determination of Soil Cleanup Objectives and Cleanup Levels.

**ATTACHMENT 1**  
**RESULTS OF WASTE CHARACTERIZATION**

Teraport Division  
100 Holmster Road  
Teraport, New Jersey 07608  
Tel: 201-283-5311  
Fax: 201-283-5300

LABORATORY ANALYSIS REPORT

**Client:** Roy F. Weston, Inc.  
1090 King Georges Post Rd  
Edison NJ 08837

**Project Manager:** Ms Smita Sumbaly  
**Project:** PM 0404

**Laboratory Report:** T410335

**Date Received:** 10/20/94

**Date Reported:** 11/8/94

<u>Lab ID No.</u>	<u>Client Sample ID</u>	<u>Matrix</u>	<u>Collection Date &amp; Time</u>
T410335 - 1	WC-1	Soil	10/20/94

  
Moe R. Amirsoleymani  
Quality Assurance Manager

N.J. Certification #02046  
N.Y. Certification #11321  
P.A. Certification #68-420

ENVIRONMENTAL PROTECTION AGENCY - REGION II  
 ENVIRONMENTAL SERVICES DIVISION  
 EDISON, NEW JERSEY 08817

T2 06358

Name of Unit and Address:

USEPA Technical Assistance Team  
 Roy F. Weston, Inc.  
 1090 King George Post Road, Suite 201  
 Edison NJ 08837

Sample Number	Number of Containers	Description of Samples
WC-1	2	16 oz waste solid } For analyze for TCL volatile, 4 oz waste solid } semi-volatile, PCB/Pesticide, TCL metals and TCLP (all factors)
	2	

Person Assuming Responsibility for Sample:

Eric Wilson

Time

Date

1700

10/22

Sample Number	Relinquished By:	Received By:	Time	Date	Reason for Change of Custody
WC-1	Eric Wilson	Ann Kellin LRI	18:30	10-20-94	For Analysis
Sample Number	Relinquished By:	Received By:	Time	Date	Reason for Change of Custody
Sample Number	Relinquished By:	Received By:	Time	Date	Reason for Change of Custody
Sample Number	Relinquished By:	Received By:	Time	Date	Reason for Change of Custody

001



VOLATILE ORGANICS METHODOLOGYEXTRACTION AND ANALYSIS, AQUEOUS

Code of Federal Regulations, Title 40, Part 136, Office of the Federal Register, National Archives and Records Administration, EPA/CLP internal and surrogate standards.

SAMPLE EXTRACTION, NON-AQUEOUS

Test Methods for Evaluating Solid Waste (SW-846), USEPA Office of Solid Waste and Emergency Response, Washington, DC 20460, 3rd Edition, November 1986, Method 5030, "Purge-and-Trap."

ANALYSIS, NON-AQUEOUS

Test Methods for Evaluating Solid Waste (SW-846), USEPA Office of Solid Waste and Emergency Response, Washington, DC 20460, 3rd Edition, November 1986, Method 8240, "Gas Chromatography/Mass Spectrometry for Volatile Organics."

## SEMIVOLATILE ORGANICS METHODOLOGY

Sample Extraction and Analysis, Aqueous

Code of Federal Regulations, Title 40, Part 136, Office of the Federal Register, National Archives and Records Administration, Washington, DC 20402, Method 625, "Base/Neutrals and Acids", modified using EPA/CLP internal and surrogate standards.

Sample Extraction, Solids

Test Methods for Evaluating Solid Waste (SW-846), USEPA Office of Solid Waste and Emergency Response, Washington, DC 20460, 3rd Edition, November 1986, Method 3550, "Sonication Extraction."

Sample Preparation, Organic Liquids

Test Methods for Evaluating Solid Waste (SW-846), USEPA Office of Solid Waste and Emergency Response, Washington, DC 20460, 3rd Edition, November 1986, Method 3580, "Waste Dilution."

Analysis, Nonaqueous

Test Methods for Evaluating Solid Waste (SW-846), USEPA Office of Solid Waste and Emergency Response, Washington, DC 20460, 3rd Edition, November 1986, Method 8270, "Gas Chromatography/Mass Spectrometry for Semivolatile Organics: Capillary Column Technique."

## METHODS SUMMARY

### ORGANIC EXTRACTIONS

Routine aqueous samples are prepared using Method 3510 (separatory funnel extraction) or Method 3520 (continuous liquid-liquid extraction) cited in SW846. Soil samples are extracted using Method 3550 (sonication extraction) from SW846.

### ALUMINA COLUMN CLEANUP

After the sample has been extracted for base/neutral semivolatiles using Method 3550, it then undergoes acid-base partition cleanup using SW846 Method 3650. The base neutral extract is then further separated using alumina column cleanup Method 3611 in SW846.

### TCLP EXTRACTION SUMMARY

Sample-requiring TCLP analyses are extracted according to Method 1311, cited in 40 CFR 261 et seq, June 29, 1990.

### PESTICIDES/PCBs

Aqueous samples are analyzed for pesticides and PCBs via USEPA Method 608. Non-aqueous samples are analyzed using Method 8080 as cited in USEPA SW846.

### HERBICIDES

The herbicide extraction and analysis is performed according to Method 509B, cited in the 16th edition of Standard Methods. Samples are extracted, derivitized, and then analyzed via a gas chromatograph utilizing an electron capture detector (ECD).

METHODS SUMMARYTRACE METALS

Reference: EPA SW846 3rd Edition, 1986 Vol. 1 A

Non-aqueous samples are digested for ICAP and GFAA according to method 3050 and for CV according to method 7470. Extracts and aqueous samples (ECRA and RCRA projects) are digested for ICAP, GFAA, and CV according to methods 3010, 3020, and 7470 respectively.

ICAP analyses are conducted in accordance with Method 6010. GFAA analyses are conducted in accordance with methods 7060 for arsenic, 7421 for lead, 7740 for selenium and 7841 for thallium. CV analyses are conducted in accordance with method 7470.

Titanium and tin are analyzed for GFAA according to methods 232.2 and 233.3 respectively (EPA 600/4-79-020, 1983 revision).

TRACE METALS

Reference: EPA 600/4-79-020, 1983 revision.

Potable water, aqueous wastes, and surface water are digested according to EPA methods 4.1.4 for GFAA and FLAA, 200.7 for ICAP, and 245.1 for CV. GFAA analyses are conducted in accordance with methods 204.4 for antimony, 206.2 for arsenic, 239.2 for lead, 270.2 for selenium, 279.2 for thallium, 232.2 for tin, and 233.2 for titanium. ICAP analyses are conducted in accordance with method 200.7, CV analyses with method 245.1, and FLAA analyses with method 273.1 for sodium only.

GFAA = Graphite furnace atomic absorption.

ICAP = Inductively Coupled Argon Plasma.

FLAA = Flame atomic absorption.

CV = Cold vapor atomic absorption for Hg.

TCDF METALS

Samples are extracted and analyzed in accordance with method 1311 published in the Federal Register, 40 CFR 261, June 29, 1990.



INORGANIC NON-CONFORMANCE SUMMARYMETALS-TOTAL

1. The quantitation limits are elevated due to matrix interference for Selenium analysis of sample T410335-01.
2. The quantitation limits are elevated due to matrix interference for Ag, Al, Ba, Be, Co, Cd, Cr, Cu, Fe, K, Mg, Mn, Na, Ni, Pb, Sb, V and Zn analysis of sample T410335-01.
3. The quantitation limits are elevated due to the dilution required for Ca and Hg analysis of sample T410335-01.
4. MS is outside of the control limit due to matrix interference for Sb, Cr, Co, Hg, Ni, K, Ag and Na analysis of sample T410004-08.
5. MSD is outside of the control limit due to matrix interference for Sb, As, Co, Hg, K, Ag and Zn analysis of sample T410004-08.
6. RPD is outside of the control limit due to matrix interference for Ba, Ca, Mg and Mn analysis of sample T410004-08.
7. ICP post digestion spike is outside of the control limit due to matrix interference for Zn analysis of sample T410004-08.
8. ICP serial dilution is outside of the control limit due to matrix interference for Fe and Zn analysis of sample T410004-08.

METALS-TCLP

1. ICP post digestion spike is outside of the control limit due to matrix interference for Ag analysis of sample T410303-04.

CASE NARRATIVE

Laboratory Resources, New Jersey Division, received one soil sample for Reduced Deliverables Format on October 20, 1994. The sample was analyzed for the parameters outlined in the chain of custody.

The sample was analyzed within the required holding time. Any parameters which were outside of their respective quality control ranges are noted in the non-conformance summaries.

Please contact us if there are any questions regarding the enclosed results.

Client Sample ID No.

Lab Name: LRI

Lab Sample ID: T410335-1A

WC-1

Matrix: [soil/water] SOIL

Lab File ID: &gt;B6369

Sample wt/vol: 5.0

[g/mL] G

Run Type: 8240VOA

Level: [low/med] LOW

Date Received: 10/20/94

% Moisture: 0.0

Date Analyzed : 11/01/94

GC Column: CAP. ID: 0.53 (mm)

Dilution Factor: 1.0

## CONCENTRATION UNITS:

CAS NO.

COMPOUND

UG/KG

Q

74-87-3-----	Chloromethane	101	U	
74-83-9-----	Bromomethane	101	U	
75-01-4-----	Vinyl Chloride	101	U	
75-00-3-----	Chloroethane	101	U	
75-09-2-----	Methylene Chloride	6		
67-64-1-----	Acetone	101	U	T
75-15-0-----	Carbon Disulfide	51	U	
75-35-4-----	1,1-Dichloroethene	51	U	
75-34-3-----	1,1-Dichloroethane	51	U	
156-60-5-----	trans-1,2-Dichloroethene	51	U	
156-59-2-----	cis-1,2-Dichloroethene	51	U	
67-66-3-----	Chloroform	51	U	
107-06-2-----	1,2-Dichloroethane	51	U	
78-93-3-----	2-Butanone	101	U	
71-55-6-----	1,1,1-Trichloroethane	51	U	
56-23-5-----	Carbon Tetrachloride	51	U	
75-27-4-----	Bromodichloromethane	51	U	
78-87-5-----	1,2-Dichloropropane	51	U	
10061-01-5-----	cis-1,3-Dichloropropene	51	U	
79-01-6-----	Trichloroethene	51	U	
124-48-1-----	Dibromochloromethane	51	U	
79-00-5-----	1,1,2-Trichloroethane	51	U	
71-43-2-----	Benzene	51	U	
10061-02-6-----	trans-1,3-Dichloropropene	51	U	
75-25-2-----	Bromoform	51	U	
108-10-1-----	4-Methyl-2-Pentanone	101	U	
591-78-6-----	2-Hexanone	101	U	
127-18-4-----	Tetrachloroethene	51	U	
79-34-5-----	1,1,2,2-Tetrachloroethane	51	U	
108-88-3-----	Toluene	51	U	
108-90-7-----	Chlorobenzene	51	U	
100-41-4-----	Ethylbenzene	51	U	
100-42-5-----	Styrene	51	U	
108-38-3-----	meta + para-Xylenes	51	U	



Client Sample ID No.

Lab Name: LRI

Lab Sample ID: T410335-1A

WC-1

Matrix: [soil/water] SOIL

Lab File ID: &gt;B6369

Sample wt/vol: 5.0 [g/mL] G

Run Type: 8240VDA

Level: [low/med] LOW

Date Received: 10/20/94

% Moisture: 0.0

Date Analyzed : 11/01/94

GC Column: CAP. ID: 0.53 (mm)

Dilution Factor: 1.0

## CONCENTRATION UNITS:

CAS NO.

COMPOUND

UG/KG

Q

95-47-6-----ortho-Xylene	51	U
--------------------------	----	---

Lab Name: LRI  
Lab Sample ID: T410335-01TCLP  
Matrix: [soil/water] WATER  
Sample wt/vol: 0.5 [g/mL] ML  
Level: [low/med] LOW  
% Moisture: NA  
GC Column: CAP ID: 0.53 (mm)  
Client Sample ID No.  
WC-1  
Lab File ID: >C6372  
Run Type: 8240VOA  
Date Received: 10/20/94  
Date Analyzed: 10/26/94  
Dilution Factor: 10.0

CAS NO.	COMPOUND	CONCENTRATION UNITS:	
		UG/L	Q
75-01-4-----	Vinyl Chloride	100	U
75-35-4-----	1,1-Dichloroethene	50	U
67-66-3-----	Chloroform	50	U
107-06-2-----	1,2-Dichloroethane	50	U
56-23-5-----	Carbon Tetrachloride	50	U
79-01-6-----	Trichloroethene	50	U
71-43-2-----	Benzene	50	U
78-93-3-----	2-Butanone	<del>100</del>	<del>U</del> R
127-18-4-----	Tetrachloroethene	50	U
108-90-7-----	Chlorobenzene	50	U

ADF: 10.00

Page 1 of 1

Total Hit(s): 0

100030

Client Sample ID No.

Lab Name: LRI

Lab Sample ID: T410335-01

WC-1

Matrix: [soil/water] SOIL

Lab File ID: &gt;D1499

Sample wt/vol: 30.00 [g/mL] G

Extract Vol: 1000 uL

Run Type: 8270SUA

Date Received: 10/20/94

% Moisture: 0.0

Date Extracted: 10/26/94

Dilution Factor: 1

Date Analyzed: 10/31/94

GPC Cleanup (Y/N) N

pH:

## CONCENTRATION UNITS:

CAS NO. COMPOUND UG/KG Q

108-95-2-----	Phenol	330IU	
111-44-4-----	bis(2-chloroethyl)ether	330IU	
95-57-8-----	2-Chlorophenol	330IU	
541-73-1-----	1,3-Dichlorobenzene	330IU	
106-46-7-----	1,4-Dichlorobenzene	330IU	
95-50-1-----	1,2-Dichlorobenzene	330IU	
95-48-7-----	2-Methylphenol	330IU	
108-60-1-----	2,2'-oxybis(1-Chloropropane)	330IU	
106-44-5-----	3&4-Methylphenol	330IU	
621-64-7-----	N-Nitroso-di-n-propylamine	330IU	
67-72-1-----	Hexachloroethane	330IU	
98-95-3-----	Nitrobenzene	330IU	
78-59-1-----	Isophorone	330IU	
88-75-5-----	2-Nitrophenol	330IU	
105-67-9-----	2,4-Dimethylphenol	330IU	
111-91-1-----	bis(2-Chloroethoxy)methane	330IU	
120-83-2-----	2,4-Dichlorophenol	330IU	
120-82-1-----	1,2,4-Trichlorobenzene	330IU	
91-20-3-----	Naphthalene	330IU	
106-47-8-----	4-Chloroaniline	330IU	
87-68-3-----	Hexachlorobutadiene	330IU	
59-50-7-----	4-Chloro-3-methylphenol	330IU	
91-57-6-----	2-Methylnaphthalene	330IU	
77-47-8-----	Hexachlorocyclopentadiene	330IU	
88-06-2-----	2,4,6-Trichlorophenol	330IU	
95-95-4-----	2,4,5-Trichlorophenol	830IU	
91-58-7-----	2-Chloronaphthalene	330IU	
88-74-4-----	2-Nitroaniline	830IU	
131-11-3-----	Dimethylphthalate	330IU	
208-96-8-----	Acenaphthylene	330IU	
606-20-2-----	2,6-Dinitrotoluene	330IU	
99-09-2-----	3-Nitroaniline	830IU	
83-32-9-----	Acenaphthene	330IU	
51-28-5-----	2,4-Dinitrophenol	830IU	
100-02-7-----	4-Nitrophenol	830IU	

671

Client Sample ID No.

Lab Name: LRI

Lab Sample ID: T410335-01

WC-1

Matrix: [soil/water] SOIL

Lab File ID: &gt;D1499

Sample wt/vol: 30.00 [g/mL] G

Extract Vol: 1000 uL

Run Type: 8270SUA

Date Received: 10/20/94

% Moisture: 0.0

Date Extracted: 10/26/94

Dilution Factor: 1

Date Analyzed: 10/31/94

GPC Cleanup (Y/N) N

pH:

## CONCENTRATION UNITS:

CAS NO.

COMPOUND

UG/KG

Q

132-64-9-----	Dibenzofuran	330IU	
121-14-2-----	2,4-Dinitrotoluene	330IU	
84-73-7-----	Diethylphthalate	330IU	
7005-72-3-----	4-Chlorophenyl-phenylether	330IU	
86-73-7-----	Fluorene	330IU	
100-01-6-----	4-Nitroaniline	830IU	
534-52-1-----	4,6-Dinitro-2-methylphenol	830IU	
86-30-6-----	N-Nitrosodiphenylamine (1)	330IU	
101-55-3-----	4-Bromophenyl-phenylether	330IU	
118-74-1-----	Hexachlorobenzene	330IU	
87-86-5-----	Pentachlorophenol	830IU	
85-01-8-----	Phenanthrene	35	J
120-12-7-----	Anthracene	330IU	
86-74-8-----	Carbazole	330IU	
84-74-2-----	Di-n-butylphthalate	330IU	82u
206-44-0-----	Fluoranthene	120	J
129-00-0-----	Pyrene	91	J
85-68-7-----	Butylbenzylphthalate	330IU	
91-94-1-----	3,3'-Dichlorobenzidine	330IU	
56-55-3-----	Benzo(a)anthracene	50	J
218-01-9-----	Chrysene	65	J
117-81-7-----	bis(2-Ethylhexyl)phthalate	330IU	
117-84-0-----	Di-n-octylphthalate	330IU	82u
205-99-2-----	Benzo(b)fluoranthene	68	J
207-08-9-----	Benzo(k)fluoranthene	36	J
50-32-8-----	Benzo(a)pyrene	60	J
193-39-5-----	Indeno(1,2,3-cd)pyrene	330IU	
53-70-3-----	Dibenz(a,h)anthracene	330IU	
191-24-2-----	Benzo(g,h,i)perylene	330IU	

S F: 33.33

Total Hit(s): 9

Client Sample ID No.

Lab Name: LRI

Lab Sample ID: T410335-01T

WC-1

Matrix: [soil/water] WATER

Lab File ID: &gt;A1639

Sample wt/vol: 400 [g/mL] ML

Extract Vol: 1000 uL

Run Type: 8270SUA

Date Received: 10/20/94

% Moisture: NA

Date Extracted: 10/27/94

Dilution Factor: 1

Date Analyzed: 10/30/94

CONCENTRATION UNITS: REGULATORY

CAS NO. COMPOUND MG/L Q LIMITS

110-86-----	Pyridine	.02IU	5.00I
106-46-----	1,4-Dichlorobenzene	.02IU	7.50I
67-72-----	Hexachloroethane	.02IU	3.00I
95-48-----	2-Methylphenol	.02IU	1200.00I
106-44-----	3&4-Methylphenol	.02IU	1200.00I
98-95-----	Nitrobenzene	.02IU	2.00I
87-68-----	Hexachlorobutadiene	.02IU	0.50I
88-06-----	2,4,6-Trichlorophenol	.02IU	2.00I
95-95-----	2,4,5-Trichlorophenol	.02IU	1400.00I
121-14-----	2,4-Dinitrotoluene	.02IU	0.13I
118-74-----	Hexachlorobenzene	.02IU	0.13I
87-86-----	Pentachlorophenol	.13IU	100.00I

SADF: 2.50

Total Hit(s): 0

## PESITICIDE AND PCB ANALYSIS DATA SHEET

Client Sample ID No.

Lab Name: LRI

Lab Sample ID: T410335-01

WC-1

Matrix: [soil/water] SOIL

Lab File ID: &gt;L9384

Sample wt/vol: 30.00 [g/ml] G

Extract VoL.: 10000 uL.

Run Type: 8080PBA

Date Received: 10/20/94.

%Moisture: NA

Date Extracted: 10/26/94

Dilution Factor: 1

Date Analyzed: 10/28/94

GC Column: RTX5 ID: 0.53

pH:

## CONCENTRATION UNITS:

UG/KG Q

CAS NO.	COMPOUND	UG/KG Q
58-89-9-----	Lindane	1.3IU
76-44-8-----	Heptachlor	1.0IU
309-00-2-----	Aldrin	1.3IU
1024-57-3-----	Heptachlor epoxide	3.3IU
959-98-8-----	Endosulfan I	1.7IU
60-57-1-----	Dieldrin	.67IU
33213-65-9-----	Endosulfan II	1.3IU
50-29-3-----	4,4'-DDT	3.3IU
7421-36-3-----	Endrin aldehyde	1.7IU
319-84-6-----	alpha-BHC	.83IU
319-85-7-----	beta-BHC	1.7IU
319-86-8-----	delta-BHC	1.7IU
5103-74-2-----	gamma-Chlordane	1.7IU
5103-71-9-----	alpha-Chlordane	1.7IU
72-55-9-----	4,4'-DDE	1.7IU
72-20-8-----	Endrin	1.7IU
72-54-8-----	4,4'-DDD	1.7IU
1031-07-8-----	Endosulfan sulfate	3.3IU
72-43-5-----	Methoxychlor	13IU
53494-70-5-----	Endrin ketone	1.7IU
8001-35-2-----	Toxaphene	8.3IU
12674-11-2-----	Aroclor 1016	17IU
11104-28-2-----	Aroclor 1221	17IU
11141-16-5-----	Aroclor 1232	17IU
53469-21-9-----	Aroclor 1242	17IU
12672-29-6-----	Aroclor 1248	17IU
11097-69-1-----	Aroclor 1254	17IU
11096-82-5-----	Aroclor 1260	17IU

SADF: .3

LABORATORY  
RESOURCES INC.

LAB JOB NO. T410335

## ANALYTICAL RESULTS: TCLP - PESTICIDE

Lab. Sample ID: T410335-01

Client Designation: WC-1

Data File: &gt;L9375

Calculation Factor: .20

Init. Amt.(ml) Extracted: 50.0

Dilution: None

QC Blank Data File: &gt;L9374

Final Vol.(ml) Extracted: 10

Total Hit(s): 0  
-----

PARAMETER	Results (MG/L)	Regulatory Limits (MG/L)
Lindane	< .00100	0.400
Heptachlor	< .00080	0.008
Heptachlor epoxide	< .00200	0.008
Endrin	< .00100	0.020
Methoxychlor	< .00800	10.000
Chlordane	< .00500	0.030
Toxaphene	< .01000	0.5 <del>0.030</del>

~~11~~ 10-28-94

LABORATORY  
RESOURCES INC.

LAB JOB NO. T410335

ANALYTICAL RESULTS: TCLP - HERBICIDE

Lab. Sample ID: T410335-01

Client Designation: WC-1

Data File: >S4537

Calculation Factor: .10

Init. Amt.(ml) Extracted: 50.0

Dilution: None

QC Blank Data File: >S4535

Final Vol.(ml) Extracted: 5

Total Hit(s): 0

-----

PARAMETER	Results (MG/L)	Regulatory Limits (MG/L)
2,4-D	< .00050	10.0
2,4,5-TP(Silvex)	< .00020	1.0



## METALS ANALYSIS DATA SHEET

Laboratory: Laboratory Resources, Inc.  
 Division: New Jersey  
 LRI Order No: T410335  
 LRI Sample No: 1

Client: Roy F. Weston Inc. - Edison  
 Location: NJ  
 Project: PM 0404  
 Sample Description: WC-1

Date Collected: 10/20/94  
 Date Received: 10/20/94

Matrix: Soil  
 Percent Moisture: N/A

Parameter	Result	QL	Units	Started Date	By	Completed Date	By	Dilution
<u>Mercury by Cold Vapor by 7470, TCLP</u>								
Mercury	0.0050 U	0.0050	mg/L	10/29/94	RJD	10/29/94	RJD	
<u>Metals by ICP by 6010, TCLP</u>								
Arsenic	1.0 U	1	mg/L	10/27/94	MG	10/28/94	MPG	
Barium	1.0 U	1	mg/L	10/27/94	MG	10/28/94	MPG	
Cadmium	0.050 U	.05	mg/L	10/27/94	MG	10/28/94	MPG	
Chromium	0.10 U	.1	mg/L	10/27/94	MG	10/28/94	MPG	
Lead	0.30 U	.3	mg/L	10/27/94	MG	10/28/94	MPG	
Selenium	0.50 U	.5	mg/L	10/27/94	MG	10/28/94	MPG	
Silver	0.050 U	.05	mg/L	10/27/94	MG	10/28/94	MPG	
<u>Arsenic by Furnace by 7060</u>								
Arsenic	500 U	500	ug/kg	10/26/94	MG	10/27/94	AMB	
<u>Mercury by Cold Vapor by 7470</u>								
Mercury	130000 N	12000	ug/kg	11/01/94	RJD	11/01/94	RJD	
<u>Metals by ICP by 6010</u>								
Aluminum	230000	25000	ug/kg	10/26/94	MG	10/27/94	MPG	
Antimony	10000 UN	10000	ug/kg	10/26/94	MG	10/27/94	MPG	
Barium	2600	1200	ug/kg	10/26/94	MG	10/27/94	MPG	
Beryllium	1200 U	1200	ug/kg	10/26/94	MG	10/27/94	MPG	
Cadmium	1200 U	1200	ug/kg	10/26/94	MG	10/27/94	MPG	
Calcium	170000000	25000	ug/kg	10/26/94	MG	10/27/94	MPG	
Chromium	2500 UN	2500	ug/kg	10/26/94	MG	10/27/94	MPG	
Cobalt	2500 UN	2500	ug/kg	10/26/94	MG	10/27/94	MPG	
Copper	6200 U	6200	ug/kg	10/26/94	MG	10/27/94	MPG	
Iron	580000	25000	ug/kg	10/26/94	MG	10/27/94	MPG	
Lead	23000	7500	ug/kg	10/26/94	MG	10/27/94	MPG	
Magnesium	170000	25000	ug/kg	10/26/94	MG	10/27/94	MPG	
Manganese	11000	1200	ug/kg	10/26/94	MG	10/27/94	MPG	
Nickel	5000 UN	5000	ug/kg	10/26/94	MG	10/27/94	MPG	
Potassium	500000 UN	500000	ug/kg	10/26/94	MG	10/27/94	MPG	
Silver	1200 UN	1200	ug/kg	10/26/94	MG	10/27/94	MPG	
Sodium	81000 N	50000	ug/kg	10/26/94	MG	10/27/94	MPG	
Vanadium	1200 U	1200	ug/kg	10/26/94	MG	10/27/94	MPG	
Zinc	11000 N	5000	ug/kg	10/26/94	MG	10/27/94	MPG	

## METALS ANALYSIS DATA SHEET

Laboratory: Laboratory Resources, Inc.  
Division: Wet Weight  
LRI Order No: T410335  
LRI Sample No: 1

Client: Roy F. Weston Inc. - Edison  
Location: NJ  
Project: PM 0404  
Sample Description: WC-1

<u>Parameter</u>	<u>Result</u>	<u>QL</u>	<u>Units</u>	<u>Started</u> <u>Date</u>	<u>By</u>	<u>Completed</u> <u>Date</u>	<u>By</u>	<u>Dilution</u>
<u>Selenium by Furnace by 7740</u>								
Selenium	1200 U	1200	ug/kg	10/26/94	MG	10/27/94	AMB	
<u>Thallium by Furnace by 7841</u>								
Thallium	250 U	250	ug/kg	10/26/94	MG	10/27/94	AMB	

**ATTACHMENT 2**

**RESULTS OF MERCURY SPECIATION**



# FRONTIER GEOSCIENCES

ENVIRONMENTAL RESEARCH CORPORATION

414 PONTIUS NORTH • SEATTLE, WA 98109  
(206) 622-6960 • FAX: (206) 622-6870

100039

Eric Wilson  
USEPA Technical assistance Team  
Roy F. Weston Inc.  
1090 King George Post Road, Suite 201  
Edison, NJ 08837

October 25, 1994

Dear Dr. Wilson,

Following please find our data report for the Hg speciation in the sample identified as WC-1 (COC #T2-06869). From our analysis, it appears as if the material is a chemical substrate, contaminated with a mercuric or mercurous salt. The sample most certainly is not mercuric sulfide (which is insoluble in dilute HCl), methyl Hg, or elemental Hg. The entire sample easily dissolved in the 4N HCl "leach", leaving a clear solution with some bits of iron-containing particles, and contained essentially the same Hg(II) concentration as did the total Hg digest. We will forward the report containing the copies of COC, raw data, calibration curves, etc. via mail. Thank you for your interest in our capabilities. I hope to have the opportunity to work with you again in the future.

Most Sincerely,



Nicolas S Bloom

# R.F. Weston Hg-Contaminated Soild (COC #T206869, Sample #WC-1)

Frontier Geosciences Inc.  
414 Pontius Avenue North, Suite B  
Seattle, WA 98109

Analysed October 21, 1994

sample ID	dry fraction	mercury concentrations, µg/g (ppm) wet weight basis					mercury concentrations, µg/g (ppm) dry weight basis				
		total	Hg(II)	MMHg	DM(Hg)	Hg(0)	total	Hg(II)	MMHg	DM(Hg)	Hg(0)
WC-1 rep 1	0.618	192.9	135.9	0.0117	<0.000002	0.0865	312.1	219.9	0.0189	<0.000003	0.140
WC-1 rep 2	0.604	177.4 183.8	237.7	0.0109	0.000006	0.0684	299.0	393.5	0.0180	0.000009	0.113
MEAN	0.611	184.7	186.8	0.0110	<0.000002	0.0774	305.6	306.7	0.0185	<0.000002	0.127
% of Total	---	---	---	---	---	---	---	≈ 100	0.0061	<0.000001	0.041
WC-1 MS	---	489.9	--	0.0185	0.000131	---	---	---	---	---	---
WC-1 MSD	---	601.8 605.1	--	0.0180	0.000109	---	---	---	---	---	---
Blank 1		0.001	0.001	0.00008	<0.000002	0.00011	---	---	---	---	---
Blank 2		--	--	0.00002	<0.000002	0.00013	---	---	---	---	---
<sup>a</sup> PACS-1	1.00	---	---	---	---	---	4.73	---	---	---	---
certified	---	---	---	---	---	---	4.57 ± 0.16	---	---	---	---
<sup>b</sup> IAEA-356	1.00	---	---	---	---	---	---	---	0.0037	---	---
<sup>b</sup> IAEA-356	1.00	---	---	---	---	---	---	---	0.0032	---	---
certified	---	---	---	---	---	---	---	---	0.0053 ± 0.0007	---	---

<sup>a</sup>NRCC certified marine harbor sediment    <sup>b</sup>IAEA Provisionally certified marine harbor sediment

**R.F. Weston Hg-Contaminated Soild (COC #T206869, Sample #WC-1)**

Frontier Geosciences Inc.  
414 Pontius Avenue North, Suite B  
Seattle, WA 98109

Analysed October 21, 1994

**Matrix Spike Summary**

species	sample ID	Hg concentrations, ug/g (ppm) wet weight basis				% rec	RPD
		unspiked	spike level	spiked	recovered		
total Hg	WC-1 MS	184.7	320.5	489.9	305.2	95.2%	
	WC-1 MSD	184.7	373.1	603.5	418.8	112.2%	16.5%
methyl Hg	WC-1 MS	0.0113	0.0066	0.0185	0.0072	109.3%	
	WC-1 MSD	0.0113	0.0086	0.0180	0.0067	78.3%	33.0%
dimethyl Hg	WC-1 MS	<0.000002	0.000124	0.000131	0.000131	105.6%	
	WC-1 MSD	<0.000002	0.000129	0.000109	0.000109	84.5%	22.2%

**Calibration Curve Summary (October 21, 1994)**

species	regression equation	correlation coefficient (r)
Total Hg and Hg(0)	PH = 171.1(ng Hg) + 2.4	0.998 (n = 9)
Dimethyl Hg	PH = 1659(ng Hg) - 1	1.000 (n = 5)
Monomethyl Hg	PH = 1192(ng Hg) - 4.3	0.999 (n = 8)

## Case Narrative: R.F. Weston Contaminated Solid (COC# T2-06869)

Frontier Geosciences Inc.  
414 Pontius Avenue North, Suite B  
Seattle, WA 98109

October 26, 1994

### I. Scope

One sample of a white industrial waste material was submitted for complete Hg speciation. The sample was to be analyzed in duplicate, with matrix spike recoveries in duplicate for Hg<sub>(total)</sub>, MMHg, and DMHg.

### II. Sample Receipt

One sample, identified as "WC-1" was received in good condition via Federal Express on October 21, 1994. Because of the high expected concentration, the sample was unpacked outside the building, rinsed and dried off, and placed in the laboratory fume hood until analysis, which occurred on the same day.

### III. Analysis

For MMHg determination, aliquots of approximately 0.15 gram were accurately weighed into tared 25.6 mL Teflon distillation vials. To each vial was sequentially added 0.5 mL of 9 M H<sub>2</sub>SO<sub>4</sub>, 0.2 mL of 20% (w/v) KCl solution, and 22.3 mL of DDW, making the total volume in the distillation vial 24 mL. Under nitrogen purge, 20.6 of 24 mL of the solution were distilled into a clean Teflon vial, which initially contained 5 mL of DDW as a trap. Thus, 20.6/24 mL (85.8%) of solution were distilled into a final total volume of 25.6 mL of water. The theoretical distillation efficiency for this method is close to the empirically determined MMHg distillation efficiency of 84.8% (n = 9, std error = 2.2%, July, 1994) determined at Frontier Geosciences on a wide variety of actual field samples. Results are reported as corrected by this empirically determined distillation factor.

Methyl Hg was separated from the distillates by aqueous phase ethylation, purging onto Carbotrap, and isothermal GC separation. For the samples 1 mL (1/25.6) of the distillate was used for analysis. The SRM and blanks were analyzed using the entire distillate volume. The ethyl-mercurial analogs are pyrolytically decomposed to Hg<sup>0</sup>, and quantified by CVAFS. Methyl Hg, is converted to methyl-ethyl mercury, which appears as the second peak on

the chromatogram. Peaks were quantified using peak height on a two pen recorder, with the sensitivity offset between the pens of 20-fold. The pen sensitivity offset (amount the smaller trace peaks must be multiplied by to be on the same scale as the more sensitive scale) is noted on the chart recorder output. The values reported on the lab bench sheets have already been multiplied by the appropriate scaling factor. All standardization was carried out using lab made methyl Hg standards which are cross calibrated to the NIST NBS-3133 aqueous total Hg standard, according to the protocol in the Frontier Geosciences QA manual.

For total Hg determination, aliquots of approximately 1.5 gram were accurately weighed into tared 100 mL volumetric flasks. To each vial was added 10 mL of a 7:3 (v/v)  $\text{HNO}_3 + \text{H}_2\text{SO}_4$  mixture. The samples refluxed for 2 hours at approximately  $150^\circ\text{C}$ . Upon cooling, the samples were then diluted to the 100 mL line with 0.002 N BrCl in water, shaken, and allowed to settle prior to analysis of the supernatant liquid. Because of the very high expected concentrations, the samples were further diluted 100:1 with 0.002N BrCl prior to analysis. The Hg(II) was determined on samples which were to be leached in 4 N HCl. Samples of approximately 0.4 grams were accurately weighed directly into 250 mL volumetric flasks full of 4N HCl. Upon addition, however, the sample completely dissolved, rather than being leached the way a sediment would be.

Hg was separated from the digests by adding an aliquot to a bubbler containing approximately 100 mL of DDW, which had been previously purged of Hg by adding  $\text{SnCl}_2$ , and passing  $\text{N}_2$  through the solution for 20 minutes. To the sample aliquot in the bubbler, additional  $\text{SnCl}_2$  was added, and then the  $\text{Hg}^0$  released was purged as above onto a gold coated sand trap, which collects the Hg by amalgamation. The Hg collected on the gold traps was electrothermally desorbed into the carrier gas stream of the detector, as  $\text{Hg}^0$ , and quantified by CVAFS. Peaks were quantified using peak height on a two-pen chart recorder, as above. All standardization was carried out using dilutions of NIST NBS-3133 aqueous total Hg standard, according to the protocol in the Frontier Geosciences QA manual. All results reported in the summary sheets have been blank corrected.

Dimethyl Hg and  $\text{Hg}(0)$  were determined using the same sample aliquot, as follows: A small aliquot (c.a. 0.15 grams) was accurately weighed into a tared bubbler containing pre-purged DDW. The sample was shaken, and purged for 20 minutes onto tandem traps. The first trap is Carbotrap, which collects the  $\text{DMHg}$ , but passes the  $\text{Hg}(0)$ , while the second trap is gold coated sand, which collects the  $\text{Hg}(0)$ . The Carbotrap is analyzed as for the methyl Hg (above), and the gold trap is analyzed as for the total Hg (above). No SRMs exist for these



species, and it is currently impossible to spike a sample with Hg(0) reproducibly. Hence, these samples only have limited QC measures associated with them.

The fraction dry weight was determined by weighing samples before and after drying overnight at  $110 \pm 5^\circ\text{C}$ . The dry fraction was determined on independent aliquots from those analyzed for Hg, to avoid volatilization losses of Hg.

#### 4. Analytical Problems Encountered

One anomaly occurred during the analysis, that being the poor reproducibility of the Hg(II) determination. This could be due to random variation in the sample, which is amplified when using very small sample aliquots. We did observe bits of iron-containing matter which did not rapidly dissolve in the HCl, which may have been irreproducibly distributed between the aliquots. Because of the very high Hg(II) levels in some of the samples, the baseline of the GC/AFS system became very ragged over the day, resulting in some degradation of the precision and accuracy of the system. Overall, the results are still precise and accurate to approximately  $\pm 20\%$  which adequately meets the goals of this investigation.

ENVIRONMENTAL PROTECTION AGENCY - REGION II  
ENVIRONMENTAL SERVICES DIVISION  
EDISON, NEW JERSEY 08817

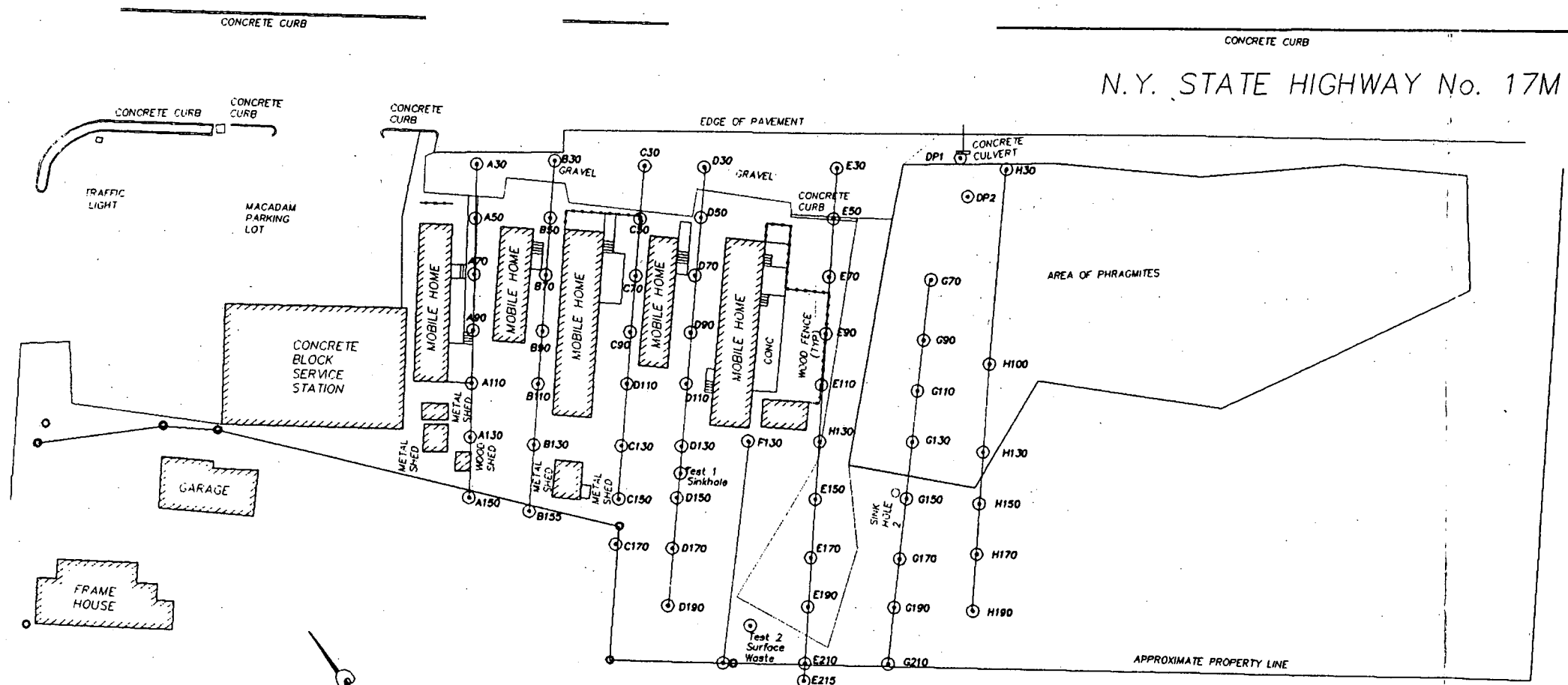
T2

Name of Unit and Address: USEPA Technical Assistance Team Roy F. Weston, Inc. 1090 King George Post Road, Suite 201 Edison, NJ 08837						
Sample Number	Number of Containers	Description of Samples				
WC-1	1	<p>4oz waste solid; analyze for:</p> <p>Total Mercury Methyl Mercury Dimethyl Mercury Elemental Mercury Ionic Mercury</p> <p>Analyze - all parameter two times using separate aliquots; report as WC-1 and WC-1 duplicate.</p> <p>Analyze matrix spike and matrix spike duplicate for Total Mercury, methylmercury and dimethyl mercury.</p> <p>Analyze standard reference materials for total mercury, methylmercury</p>				
Person Assuming Responsibility for Sample: Eric Wilson [(908) 225-6116]					Time 1700	Date 10/22
Sample Number	Relinquished By:	Received By:	Time	Date	Reason for Change of Custody	
WC-1	Eric Wilson	Fedex Airbill # 0660539 504	1945	10/22/94	For transport to lab	
Sample Number	Relinquished By:	Received By:	Time	Date	Reason for Change of Custody	
		Eric Wilson FG	1000 am	10/21 94		
Sample Number	Relinquished By:	Received By:	Time	Date	Reason for Change of Custody	
Sample Number	Relinquished By:	Received By:	Time	Date	Reason for Change of Custody	

**ATTACHMENT 3**

**FIGURES**

COUNTY HIGHWAY 71

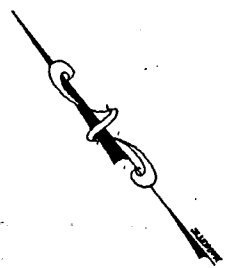


LEGEND:

- ⊙ Sample Location  
H190 Sample Identification

Scale 1" = 40'

FIGURE 1 - SAMPLING LOCATION MAP  
PYRIDIUM MERCURY DISPOSAL SITE NO. 1  
HARRIMAN, NEW YORK  
OCTOBER 12, 20, 1994



① Sample Location  
114 Estimated Mercury  
concentration(mg\kg)  
100 Mercury concentration  
Less Than 90mg\kg

FIGURE 2 - MERCURY CONCENTRATION MAP  
PYRIDIUM MERCURY DISPOSAL SITE NO. 1  
HARRIMAN, NEW YORK  
OCTOBER 13 - 20, 1994

**Pyridium Mercury Disposal Site No. 1**  
**Harriman, New York**  
**Vacuum Sampling of Mobile Homes Report**

Prepared by:

Technical Assistance Team  
Roy F. Weston, Inc.  
Federal Programs Division  
Edison, New Jersey 08837

Prepared for:

James D. Harkay  
Region II Removal Action Branch  
United States Environmental Protection Agency  
Edison, New Jersey 08837

May 1995

VACUUM AIR SAMPLING REPORT  
PYRIDIDIUM MERCURY DISPOSAL SITE NO. 1  
HARRIMAN, NEW YORK

I. SITE HISTORY

A. Site Description

The Pyrididium Mercury Disposal Site No. 1 (Pyrididium 1) is a trailer park located at the intersection of State Route 17M and Harriman Heights Road in the Village of Harriman, Orange County, New York (Latitude: 41° 18' 23.6" N, Longitude: 74° 9' 13.3" W). (Figure 1, Attachment A.) Five mobile home trailers are located at the trailer park. (Figure 2, Attachment A.) All the trailers were occupied as residential dwellings.

A white clay-like material, discovered at the trailer park, was used to fill low-lying areas of a wetland. This material was reportedly waste, generated from niacinamide production by the Pyrididium Corporation during the 1940s and 1950s. Nepera Inc. of Harriman, New York, currently owns and operates the former Pyrididium Corporation facility.

In October 1994, the United States Environmental Protection Agency (EPA) collected samples of the waste on-site and detected mercury in concentrations up to 657 milligrams per kilogram (mg/kg). Mercury speciation analysis indicated the mercury to be present in the form of a mercuric or mercurous salt.

B. Previous Actions

On November 28, 1994, Nepera Inc. signed an Administrative Order on Consent (AOC) with the EPA agreeing to relocate the residents of the trailer park. In January, February and March 1995, the five mobile homes were vacated.

Based upon the condition of the trailers and with the owner's permission, the EPA determined that trailers No. 3 and 5 would be decontaminated, transported off site and resold. Because of their age and overall poor condition, Trailers No. 1, 2 and 4 would be demolished and disposed of as non-hazardous debris in a sanitary landfill.

From February 13 to 20, trailers No. 3 and 5 were cleaned. Following the removal of all remaining furniture and carpeting, the trailers were vacuumed and cleaned three times with soap and bleach. The furniture and carpeting were disposed of, along with the debris from trailers No. 1, 2 and 4, at the Orange County Landfill in Goshen, New York.

On February 20, the heating ducts under trailers No. 3 and 5 were cleaned. An air compressor was used to push dust particulates through the duct into a HEPA-VAC unit. Afterwards, a snake with a brush attachment was pulled through the ducts to loosen any remaining dust. The ducts were vacuumed a final time with the HEPA-VAC unit.

On February 21, the EPA requested the Technical Assistance Team (TAT) to conduct vacuum air-assisted sampling in trailers No. 3 and 5. The analytical results of the vacuum sampling were used to determine the cleanup verification parameters. The parameters, the contaminant loading and mercury concentration in dust, confirmed that the trailers had been properly decontaminated prior to transportation off site.

## II. VACUUM AIR-ASSISTED SAMPLING METHODOLOGY

### A. Laboratory Analytical Method

The vacuum samples were analyzed, using a modified NIOSH Method 6009 (See Appendix B). NIOSH Method 6009 was originally designed for air sample collection of elemental mercury vapors in a sorbent collection media. However, NIOSH Method 6009 recommends the use of a pre-filter to exclude particulate mercury species from the air sample.

The contaminant of concern at the site is a solid mercuric or mercurous salt, a particulate mercury species. Therefore, NIOSH Method 6009 was modified to analyze for this site specific contaminant by using a 37 milli-meter (mm) three piece cartridge (3PC) membrane filter, instead of the sorbent tube.

### B. Sampling Procedure Summary

The vacuum air-assisted sampling procedure, used at Pyridium 1, was adapted from a similar procedure, used for lead dust at the Clinton Avenue/Bender Street Site in Buffalo, New York.

The samples were collected, utilizing a vacuum air-assisted apparatus. The sampling apparatus consisted of mercury-free plastic tubing, a plastic vacuum nozzle, a three-piece filter holder with a 37 mm 3PC membrane filter and a portable vacuum pump with a sampling rate of 4.5 liters per minute (L/min).

Each sample was collected on an  $0.0625 \text{ m}^2$  surface area which was outlined with a 25 cm by 25 cm template. Each surface



area was sampled by passing the apparatus in the two directions, up/down and right/left. The apparatus was passed in each direction for an interval of 2 minutes, for a total sample time of 4 minutes.

After each sample was collected, the filter was detached from the sampling apparatus, recapped and placed in a resealable plastic bag in preparation for shipment. The vacuum attachment and plastic tubing were changed and discarded after each sample was collected.

Each sample was accurately identified with a moisture-resistant label. Sample containers were labeled prior to sample collection. Each label listed the date and time of sample collection, sample identity/location and analysis requested.

Field data and observations were entered in a bound site logbook and a field data summary sheet. (See Attachment B).

The samples were shipped to the laboratory with an EPA Chain of Custody, as per EPA Standard Operation Procedures. The chain of custody form listed number of sample containers; description of each sample; date of sample collection; and date and time of custody transfer to the laboratory (see Attachment C).

#### C. Quality Assurance and Quality Control (QA/QC)

The laboratory was furnished with a lot blank, trip blank and a field blank to serve as QA/QC samples to ensure accurate data.

A lot blank, consisting of two unopened filters with the same lot number as the filter used in sampling, was analyzed to ensure that no contamination occurred during the manufacture of the filter.

A trip blank, a clean filter opened once in the sample packaging area, was analyzed to ensure that no contamination occurred during the packaging of the samples for shipment to the laboratory.

A field blank, an opened filter worn throughout the sampling, was analyzed to document that sampling protocols were followed and that no cross-contamination between samples occurred.

#### D. Cleanup Verification Parameters

The decontamination of the trailers was confirmed by the cleanup verification parameters, which are the contaminant

loading and the mercury concentration in dust. The contaminant loading was used to measure the amount of mercury on a surface area. The mercury concentration in dust was used to determine the actual mercury concentration in the dust from the vacuumed surface. The following calculations were used to determine the cleanup verification values:

$$i. \text{ Contaminant Loading} = \frac{\text{Mercury Mass}}{\text{Surface Area}}$$

The contaminant loading for each sample was reported in micrograms per square meter ( $\mu\text{g}/\text{m}^2$ ). The mercury mass was determined, using a modified NIOSH Method 6009. The surface area was the area vacuumed ( $0.0625 \text{ m}^2$ ).

$$ii. \text{ Mercury Concentration in Dust} = \frac{\text{Mercury Mass}}{\text{Dust Mass}}$$

The mercury concentration in each dust sample was reported in mg Hg/kg or parts per million (ppm). The dust mass was calculated by subtracting the pre-weight of the filter from the post-sampling weight of the filter.

### III. VACUUM SAMPLING RESULTS

#### A. Sampling Activities

On February 21, six vacuum air-assisted samples were collected from trailers No. 3 and 5, in accordance with the methodology specified in Sections II A and B. The vacuum samples were collected from three areas of heavy use in each trailer: the kitchen floor, the hallway floor and the bathroom wall. (Figure 3, Attachment A.) The kitchen floor samples were collected from vinyl surfaces within three feet of the sink in both trailers.

The hallway floor sample of trailer No. 3 was collected from a vinyl surface, approximately two feet in front of the bathroom door. The hallway floor sample of trailer No. 3 was collected from a particle board surface within two feet of the heating/cooling unit.

The bathroom wall sample of trailer No. 3 was collected from the wallpaper, approximately 6 inches below the towel rack. The bathroom wall sample of trailer No. 5 was collected from the wallpaper, approximately 6 inches above the toilet paper rack.

The vacuum samples were shipped to MDS Laboratory in Reading, Pennsylvania, to be analyzed for mercury mass and dust mass, the values were needed to determine the contaminant loading and the mercury concentration for each dust sample.

The laboratory was unable to determine dust mass because the filters used for sampling were not pre-weighed. Therefore, only the contaminant loading could be calculated for the vacuum samples, collected on February 21.

On February 27, six additional vacuum samples were collected from trailers No. 3 and 5. The floor samples were collected at locations within 2 feet of the first vacuum samples. The bathroom wall samples were collected approximately 6 inches above the light switch in trailers No. 3 and 5.

Pre-weighed filters were used in the sampling and the laboratory was able to determine the dust mass as well as the mercury mass. Therefore, the mercury concentration in dust and the contaminant loading could be calculated for the samples.

#### B. Analytical Results (Mercury Mass)

The vacuum sampling analytical results for February 21 and 27 are presented in Attachment D. The mercury masses for both sampling dates are listed below in Table 1. The kitchen and hallway samples for trailers No. 3 and 5 were not collected at the same exact location, rather, within 2 feet of each other.

Table 1: Analytical Results (Mercury Mass) of Vacuum Sampling		
Sample Location	Date Sampled	Mercury Mass (ug)
Trailer No. 3: Kitchen Floor By Sink (Vinyl Surface)	02/21/95	0.168
	02/27/95	0.473
Trailer No. 3: Hallway Floor By Bathroom Door (Vinyl Surface)	02/21/95	0.440
	02/27/95	0.454
Trailer No. 3: Bathroom Wall Below Towel Rack (Paper Surface)	02/21/95	< 0.025
Trailer No. 3: Bathroom Wall Above Light Switch (Paper Surface)	02/27/95	< 0.025

Table 1: Analytical Results (Mercury Mass) of Vacuum Sampling		
Sample Location	Date Sampled	Mercury Mass (ug)
Trailer No. 5: Kitchen Floor By Sink (Vinyl Surface)	02/21/95	< 0.025
	02/27/95	< 0.025
Trailer No. 5: Hallway Floor By Heating/Cooling Unit (Particle Board Surface)	02/21/95	0.040
	02/27/95	0.112
Trailer No. 5: Bathroom Wall Above Toilet Paper Rack (Paper Surface)	02/21/95	< 0.025
Trailer No. 5: Bathroom Wall Above Light Switch (Paper Surface)	02/21/95	< 0.025
Field Blank	02/21/95	< 0.025
Trip Blank	02/21/95	< 0.025
Lot Blank	02/21/95	< 0.025

Mercury, above the method detection limit of 0.025 ug, was found in the same three sampling locations on February 21 and 27: the kitchen and hallway floors of trailer No. 3 and from the hallway floor of trailer No.5. The respective mercury masses of 0.168 ug and 0.473 ug were detected in the samples collected from the kitchen floor of trailer No. 3. Mercury masses of 0.440 ug and 0.454 ug, respectively, were detected in the hallway floor samples of trailer No. 3. The samples, collected from the hallway floor of trailer No. 5 had mercury masses of 0.040 ug and 0.112 ug, respectively.

No mercury was detected above the method detection limit of 0.025 ug in the samples collected from the kitchen floor of trailer No. 5 nor from any of the four bathroom walls. Additionally, no mercury above the detection limit was detected in the field, trip or lot blanks.

**C. Cleanup Verification Parameters (Contaminant Loading and Mercury Concentration in Dust)**

The contaminant loading and mercury concentration in dust for the vacuum samples, collected on February 21 and 27 are listed below in Table 2. The cleanup verification values were calculated using the respective equations described in Section II C. The contaminant loading and the mercury concentration per dust were not calculated for samples with a mercury mass below the detection limit of 0.025 ug.

**Table 2: Cleanup Verification Parameters (Contaminant Loading and Mercury Concentration per Dust)**

Sample Location	Date Sampled	Contaminant Loading (ug/m <sup>2</sup> )	Mercury Concentration in Dust (mg/kg)
Trailer No. 3: Kitchen Floor By Sink (Vinyl Surface)	02/21/95	2.69	N/A
	02/27/95	7.57	24.3
Trailer No. 3: Hallway Floor By Bathroom Door (Vinyl Surface)	02/21/95	7.04	N/A
	02/27/95	7.26	9.7
Trailer No. 3: Bathroom Wall Below Towel Rack (Paper Surface)	02/21/95	*	*
Trailer No. 3: Bathroom Wall Above Light Switch (Paper Surface)	02/27/95	*	*
Trailer No. 5: Kitchen Floor By Sink (Vinyl Surface)	02/21/95	*	*
	02/27/95	*	*
Trailer No. 5: Hallway Floor By Heating/Cooling Unit (Particle Board Surface)	02/21/95	0.64	N/A
	02/27/95	1.79	2.5
Trailer No. 5: Bathroom Wall Above Toilet Paper Rack (Paper Surface)	02/21/95	*	*
Trailer No. 5: Bathroom Wall Above Light Switch (Paper Surface)	02/21/95	*	*
Field Blank	02/21/95	*	*
Trip Blank	02/21/95	*	*
Lot Blank	02/21/95	*	*

\* Not calculated because mercury mass was below the detection limit of 0.025 ug for NIOSH 6009.

The contaminant loadings for the vacuum samples, collected on February 21 and 27, with mercury masses above the detection limit ranged from 0.64 ug/m<sup>2</sup> to 7.57 ug/m<sup>2</sup>. The

contaminant loadings of the trailer No. 3 kitchen floor samples were 2.69 ug/m<sup>2</sup> and 7.57 ug/m<sup>2</sup>, respectively. The contaminant loadings for the trailer No. 3 hallway floor samples were 7.04 ug/m<sup>2</sup> and 7.26 ug/m<sup>2</sup>, respectively. The contaminant loadings for the trailer No. 5 hallway floor were 0.64 ug/m<sup>2</sup> and 1.79 ug/m<sup>2</sup>, respectively.

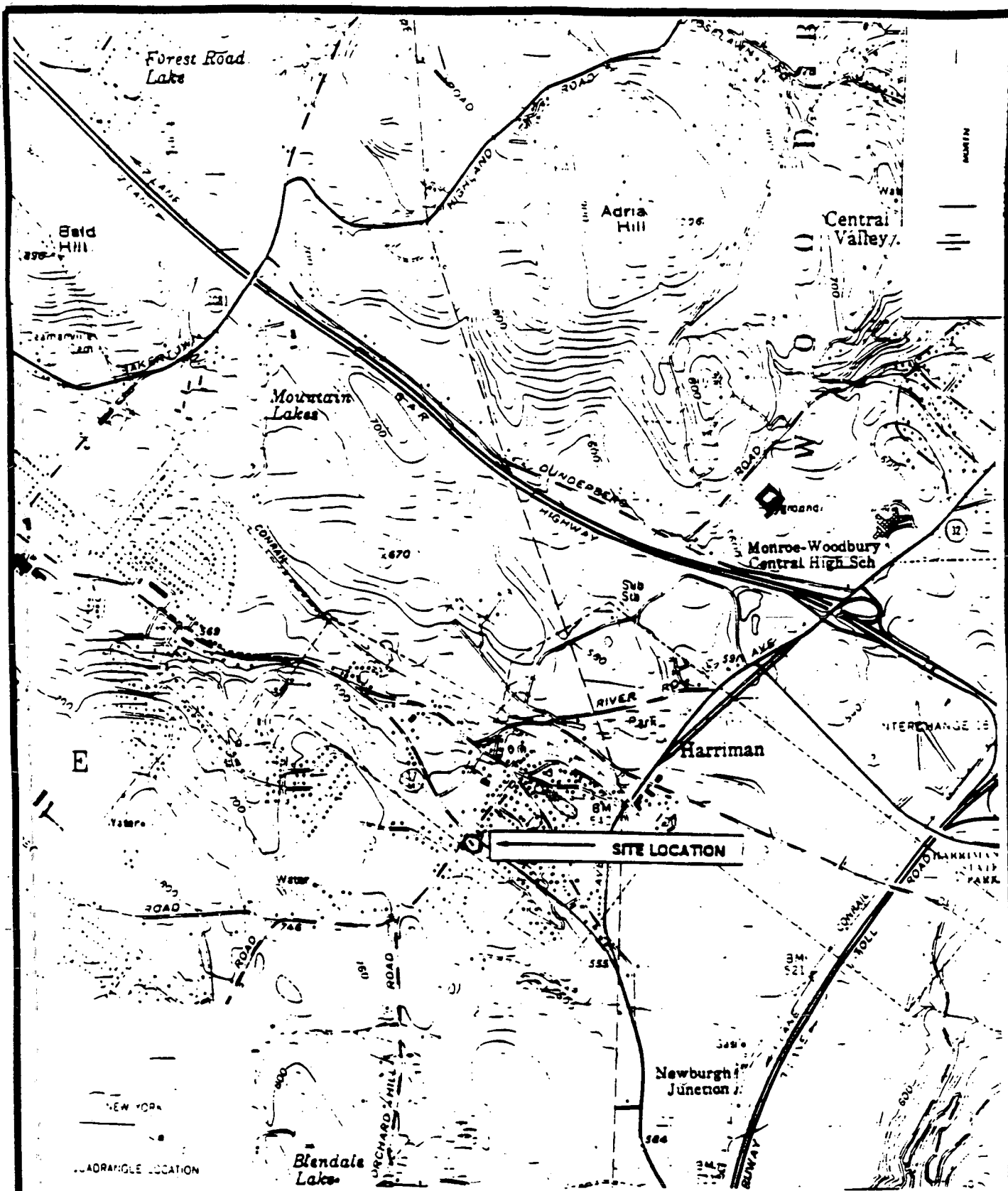
The mercury concentrations in dust for the vacuum samples, collected on February 27, with mercury masses above the detection limit, ranged from 2.5 mg/kg to 24.3 mg/kg. The sample, collected from the kitchen floor of Trailer No. 3, had a mercury concentration per dust of 24.3 mg/kg. The sample, collected from the hallway floor of trailer No. 3, had a mercury concentration of 9.7 mg/kg. The sample, collected from the hallway floor of trailer No. 5, had a mercury concentration of 2.5 mg/kg.

#### IV. CONCLUSIONS

The cleanup verification vacuum samples were biased samples deliberately collected from areas of heavy use, and likely contamination. Low concentrations of mercury were detected in dust collected from the vinyl floors of trailer No. 3 and the particle board hallway floor of trailer No. 5. No mercury above the detection limit was detected in the vacuum samples, collected from the bathroom walls of trailers No. 3 and 5.

The analytical results of the vacuum sampling were submitted to the Agency of Toxic Substance and Disease Registry (ATSDR) for review. In a Record of Activity, signed on April 3, 1995, the ATSDR concluded that the mercury concentrations, detected in trailers No. 3 and No. 5, were below levels of health concern. (See Attachment E). Subsequently, trailers No. 3 and 5 were transported off site and sold.

ATTACHMENT A  
SITE FIGURES



**WESTON**  
MANAGEMENT CONSULTANTS

Roy F. Weston, Inc.  
 MAJOR PROGRAMS DIVISION

IN ASSOCIATION WITH FOSTER WHEELER CORP.,  
 C.C. JOHNSON & MALHOTRA, P.C., RESOURCE  
 APPLICATIONS, INC. AND R.E. SARRIERA ASSOCIATES

EPA PM

D. HARKAY

TAT PM

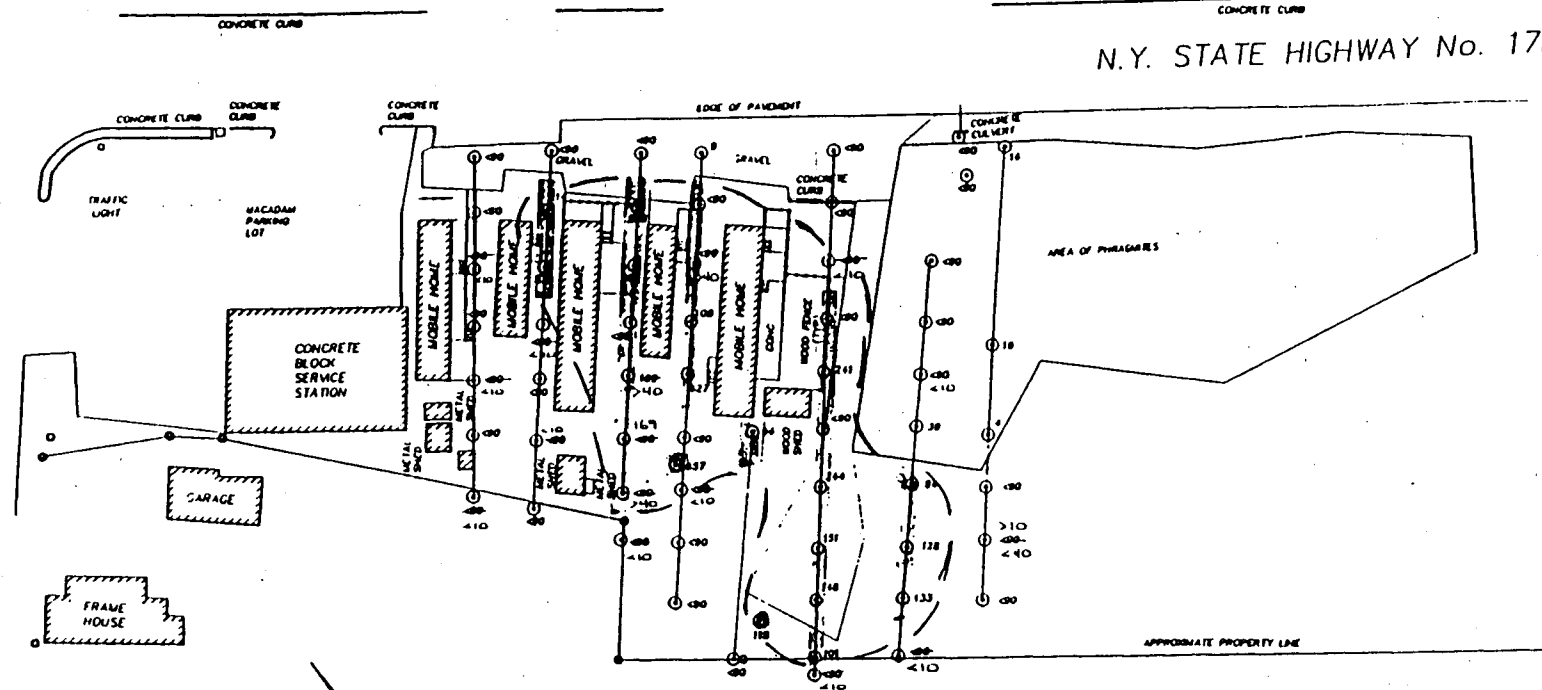
S. MAY

FIGURE 1  
 SITE LOCATION MAP

PYRIDUM MERCURY  
 DISPOSAL SITE NO. 1



COUNTY HIGHWAY 71



**LEGEND**

- ⊙ Sample Location
- ⊖ Estimated Mercury concentration (ng/kg)
- Mercury concentration Less Than 90ng/kg

**WESTON**

Roy F. Weston, Inc.  
MAJOR PROGRAMS DIVISION

IN ASSOCIATION WITH FOSTER WHEELER CORP.,  
C.C. JOHNSON & MATHOTTA, P.C., RESOURCE  
APPLICATIONS, INC. AND R.E. SANTIENA ASSOCIATES

EPAPM

D. HARKAY

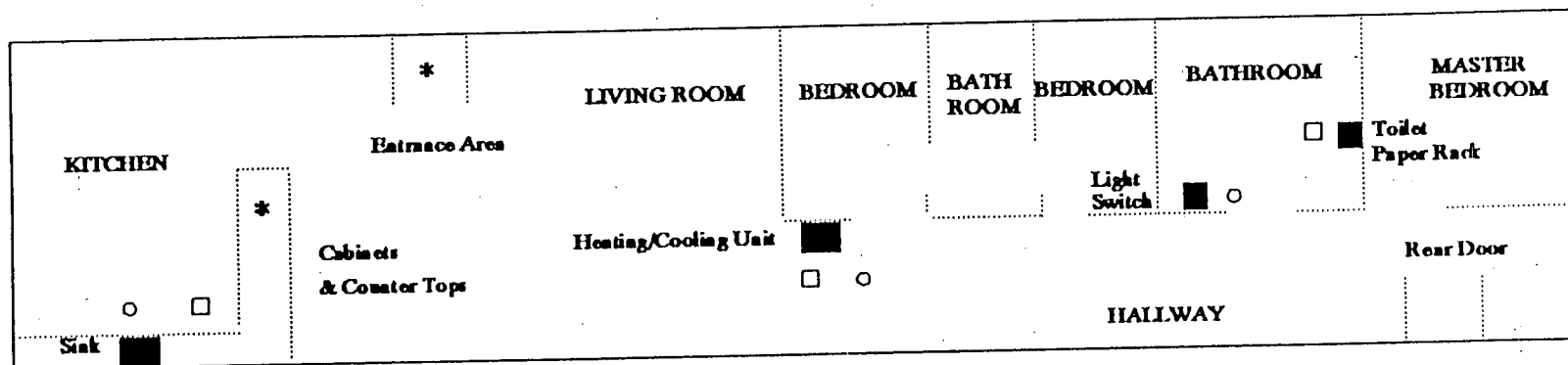
TATPM

S. MAY

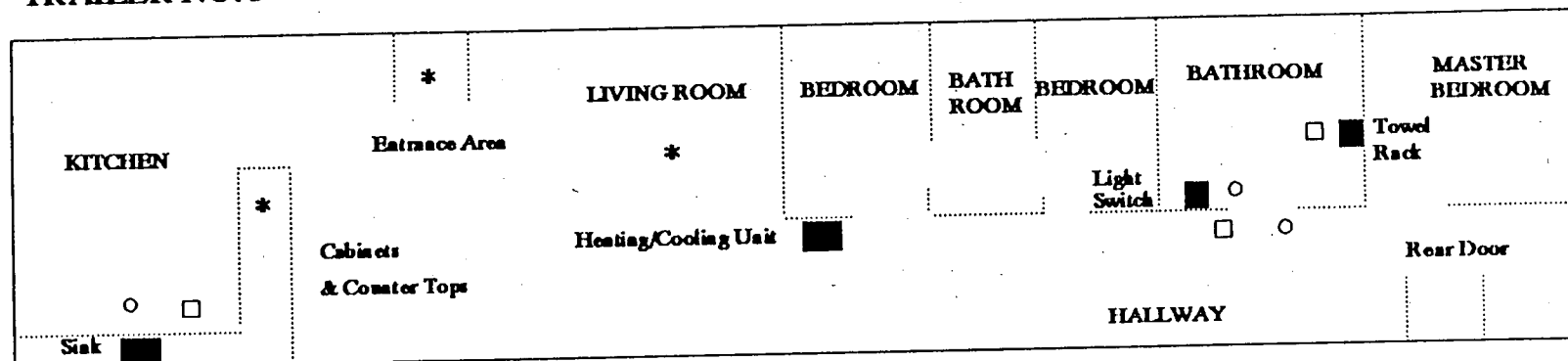
FIGURE 2  
SITE MAP

PYRIDIUM MERCURY  
DISPOSAL SITE NO. 1

100060



TRAILER NO. 5



TRAILER NO. 3

- LEGEND:**
- \* DUST SAMPLING LOCATIONS (11/17/94)
  - VACUUM SAMPLING LOCATIONS (02/21/95)
  - VACUUM SAMPLING LOCATIONS (02/27/95)

Not to Scale



Roy F. Weston, Inc.  
MAJOR PROGRAMS DIVISION

IN ASSOCIATION WITH FOSTER WHEELER CORP.,  
C.C. JOHNSON & MALHOTRA, P.C., REBOURCE  
APPLICATIONS, INC. AND R.E. BARRERA ASSOCIATES

EPA PM

D. Hartay

Figure 3: Dust/Vacuum  
Sample Locations

TAT PM

S. May

Pyridium 1  
Harrison, New York

100061

ATTACHMENT B

NIOSH METHOD 6009

FORMULA: Hg

MERCURY

METHOD: 6009

ISSUED: 5/15/89

M.W.: 200.59

OSHA: 0.05 mg/m<sup>3</sup> (skin)  
 NIOSH: 0.05 mg/m<sup>3</sup> (skin) [1]  
 ACGIH: 0.05 mg/m<sup>3</sup>

PROPERTIES: liquid; d 13.55 g/mL @ 20 °C; BP  
 356 °C; MP -39 °C; VP 0.16 Pa  
 (0.0012 mm Hg; 13.2 mg/m<sup>3</sup>) @ 20 °C

SYNONYMS: quicksilver; CAS# 7439-97-6.

SAMPLING	MEASUREMENT
SAMPLER: SOLID SORBENT TUBE (Hydrar in single section, 200 mg)	! TECHNIQUE: ATOMIC ABSORPTION, COLD VAPOR
FLOW RATE: 0.15 to 0.25 L/min	! ANALYTE: elemental mercury
VOL-MIN: 2 L @ 0.05 mg/m <sup>3</sup> -MAX: 100 L	! DESORPTION: conc. HNO <sub>3</sub> /HCl @ 25 °C, dilute to 50 mL
SHIPMENT: routine	! WAVELENGTH: 253.7 nm
SAMPLE STABILITY: 30 days @ 25 °C [2]	! CALIBRATION: standard solutions of Hg <sup>++</sup> in 1% HNO <sub>3</sub>
FIELD BLANKS: 10% of samples	! RANGE: 0.1 to 1.2 µg per sample
MEDIA BLANKS: at least 3 per set	! ESTIMATED LOD: 0.03 µg per sample
	! PRECISION (s <sub>r</sub> ): 0.042 @ 0.9 to 3 µg per sample [4]
ACCURACY	
RANGE STUDIED: 0.002 to 0.8 mg/m <sup>3</sup> [3] (10-L samples)	
BIAS: not significant [2,3]	
OVERALL PRECISION (s <sub>r</sub> ): not determined	
APPLICABILITY: The working range is 0.01 to 0.5 mg/m <sup>3</sup> for a 10-L air sample. The sorbent material irreversibly collects elemental mercury. A prefilter can be used to exclude particulate mercury species from the sample. The prefilter can be analyzed by similar methodology. The method has been used in numerous field surveys [4].	
INTERFERENCES: Inorganic and organic mercury compounds may cause a positive interference. Oxidizing gases, including chlorine, do not interfere.	
OTHER METHODS: This replaces method 6000 and its predecessors, which required a specialized desorption apparatus [5,6,7]. This method is based on the method of Rathje and Marcero [8] and is similar to the OSHA method ID 145H [3].	

## REAGENTS:

1. Water, organics-free, deionized.
2. Hydrochloric acid (HCl), conc.
3. Nitric acid (HNO<sub>3</sub>), conc.
4. Mercuric oxide, reagent grade, dry.
5. Calibration stock solution, Hg<sup>++</sup>, 1000 µg/mL. Commercially available or dissolve 1.0798 g of dry mercuric oxide (HgO) in 50 mL of 1:1 hydrochloric acid, then dilute to 1 L with deionized water.
6. Intermediate mercury standard, 1 µg/mL. Place 0.1 mL 1000 µg/mL stock into a 100 mL volumetric containing 10 mL deionized water and 1 mL hydrochloric acid. Dilute to volume with deionized water. Prepare fresh daily.
7. Stannous chloride, reagent grade, 10% in 1:1 HCl. Dissolve 20 g stannous chloride in 100 mL conc. HCl. Slowly add this solution to 100 mL deionized water and mix well. Prepare fresh daily.
8. Nitric acid, 1% (w/v).---

## EQUIPMENT:

1. Sampler: glass tube, 7 cm long, 6-mm OD, 4-mm ID, flame sealed ends with plastic caps, containing one section of 200 mg Hydrar held in place by glass wool plugs (commercially available from SKC, Inc., Cat. #226-17-1).  
NOTE: A 37-mm, cellulose ester membrane filter in a cassette preceding the Hydrar may be used if particulate mercury is to be determined separately.
2. Personal sampling pump, 0.15 to 0.25 L/min, with flexible connecting tubing.
3. Atomic absorption spectrophotometer with cold vapor generation system (see Appendix) or cold vapor mercury analysis system.\*
4. Strip chart recorder.
5. Flasks, volumetric, 50-mL, and 100-mL.
6. Pipet, 5-mL, 20-mL, others as needed.
7. Micropipet, 10- to 1000-µL.
8. Bottles, biological oxygen demand (BOD), 300-mL.

\*See SPECIAL PRECAUTIONS

**SPECIAL PRECAUTIONS:** Mercury is readily absorbed by inhalation and intact skin. Operate the mercury system in a hood, or bubble vented mercury through a mercury scrubber.

## SAMPLING:

1. Calibrate each personal sampling pump with a representative sampler in line.
2. Break ends of sampler immediately prior to sampling. Attach sampler to pump with flexible tubing.
3. Sample at an accurately known flow rate of 0.15 to 0.25 L/min for a sample size between 2 and 100 L.  
NOTE: Include a minimum of three unopened sampling tubes from the same lot as the samples for use as media blanks.
4. Cap sampler and pack securely for shipment.

## SAMPLE PREPARATION:

5. Place the Hydrar sorbent and the front glass wool plug from each sampler in separate 50-mL volumetric flasks.
6. Add 2.5 mL conc. HNO<sub>3</sub> followed by 2.5 mL conc. HCl.  
NOTE: The mercury must be in the oxidized state to avoid loss. For this reason, the nitric acid must be added first.
7. Allow the sample to stand for 1 hour or until the black Hydrar sorbent is dissolved. The solution will turn dark brown and may contain undissolved material.
8. Carefully dilute to 50 mL with deionized water. (Final solution is blue to blue-green).
9. Using a volumetric pipet, transfer 20 mL of the sample to a BOD bottle containing 80 mL of deionized water. If the amount of mercury in the sample is expected to exceed the standards a smaller aliquot may be taken, and the volume of acid adjusted accordingly. The final volume in the BOD bottle must be 100 mL. To prevent possible loss of mercury during transfer, place the pipet tip below the surface of the liquid in the BOD bottle.

## CALIBRATION AND QUALITY CONTROL:

10. Prepare a minimum of two series of working standards covering the range 0.01 to 0.5  $\mu\text{g}$  Hg per aliquot by adding known amounts of the intermediate standard to 800 bottles containing enough 1% nitric acid to bring the final volume to 100 mL.
11. Analyze the working standards together with the samples and blanks (steps 13 through 16). Analyze full set of standards at the beginning of the run, and a second set at the end of the run. Additional standards may be run intermediately during the analysis to confirm instrument response.
12. Prepare calibration graph (peak height from the recorder vs. solution concentration,  $\mu\text{g}/\text{sample}$ ).

## MEASUREMENT:

13. Zero the spectrophotometer by removing the bubbler from the 800 bottle, allowing the baseline on the recorder to stabilize.
14. Place the bubbler in a 800 bottle containing 0.5  $\mu\text{g}$  mercury in 100 mL 1% nitric acid. Adjust the spectrophotometer so that it will give a 75% to full-scale deflection of the recorder.
15. Vent the mercury vapor from the system.
16. Analyze standards, samples and blanks (including media blanks).
  - a. Remove the bubbler from the 800 bottle.
  - b. Rinse the bubbler with deionized water.
  - c. Allow the recorder tracing to establish a stable baseline.
  - d. Remove the stopper from the 800 bottle containing the next sample to be analyzed. Gently swirl the 800 bottle.
  - e. Quickly add 5 mL 10% stannous chloride solution.
  - f. Quickly place the bubbler into the 800 bottle.
  - g. Allow the spectrophotometer to attain maximum absorbance.
  - h. Vent the mercury vapor from the system.
  - i. Rinse the bubbler using deionized water.
  - j. Place the bubbler into an empty 800 bottle. Continue venting the mercury until a stable baseline is obtained.
  - k. Close the mercury vent.

## CALCULATIONS:

17. Calculate the amount of mercury in the sample aliquot ( $W, \mu\text{g}$ ) from the calibration graph.
18. Calculate the concentration  $C$  ( $\text{mg}/\text{m}^3$ ), of mercury in the air volume sampled,  $V$  (L):

$$C = [W \cdot (V_s/V_a) - B] / V$$

Where:

 $V_s$  = original sample volume (step 8; normally 50 mL) $V_a$  = aliquot volume (step 9; normally 20 mL) $B$  = average amount of mercury present in the media blanks

## EVALUATION OF METHOD:

Rathje and Marcero originally used Hopcalite (MSA, Inc.) as the sorbent material [8]. Later, Hopcalite was shown superior to other methods for the determination of mercury vapor [9]. Atmospheres of mercury vapor for the study were dynamically generated in the range 0.05 to 0.2  $\text{mg}/\text{m}^3$  and an adsorbent tube loading of 1 to 7  $\mu\text{g}$  was used. The Hydrar material used in the present method is similar to Hopcalite. No significant difference in the laboratory analysis of mercury collected on the two sorbent materials was observed [10]. OSHA also validated a method for mercury using Hydrar [3]. An average 99% recovery, with  $s_r = 0.042$ , was seen for 18 samples with known amounts (0.9 to 3  $\mu\text{g}$ ) of mercury added (as  $\text{Hg}(\text{NO}_3)_2$ ) [11]. No change in recovery was seen for samples stored up to 3 weeks at room temperature or up to 3 months at  $-15^\circ\text{C}$ ; longer storage times were not investigated [11].

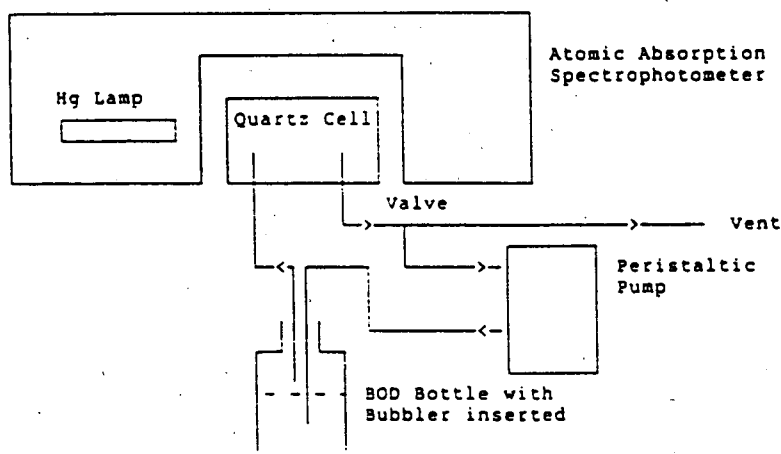
## REFERENCES:

- [1] NIOSH Testimony, OSHA Proposed Rules on Air Contaminants, Docket #H-020, August 1, 1988.

- [2] Evaluation of Mercury Solid Sorbent Passive Dosimeter. Backup Data Report. Inorganic Section, OSHA Analytical Laboratory, Salt Lake City, Utah, 1985.
- [3] Mercury in Workplace Atmospheres (Hydrar Tubes). Method ID 145H, Inorganic Section, OSHA Analytical Laboratory, Salt Lake City, Utah, 1987.
- [4] NIOSH/MRSB. Reports for Analytical Sequence Nos. 5854, 5900, 6219, and 6311, NIOSH (Unpublished, 1987-1988).
- [5] NIOSH Manual of Analytical Methods, 3rd. ed., Method 6000. (1984).
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- [7] Ibid., V.5, P&CAM 175, Publ. (NIOSH) 79-141 (1979).
- [8] Rathje, A. O., Marcero, D. H. Improved hopcalite procedure for the determination of mercury in air by flameless atomic absorption, Am. Ind. Hyg. Assoc. J. 37:311-314 (1976).
- [9] McCammon, C. S., Edwards, S. L., Hull, R. D., Woodfin, W. J., A comparison of four personal sampling methods for the determination of mercury vapor, Am. Ind. Hyg. Assoc. J., 41:528-531 (1980).
- [10] Internal Methods Development Research, Data Chem, Inc., Salt Lake City, Utah (1982).
- [11] Eller, P.M., NIOSH, unpublished data (1987-88).

METHOD WRITTEN BY: Keith R. Nicholson and Michael R. Steele, Data Chem, Inc., Salt Lake City, Utah. under NIOSH contract No. 200-87-2533.

#### APPENDIX: Cold Vapor Mercury Analysis System



1. The valve should direct the vented vapors to a hood or to a mercury scrubber system.
2. When the valve is opened to "Vent" the peristaltic pump should draw room air. Place a Hydrar tube in the air intake to eliminate any mercury that may be present.
3. Adjust the peristaltic pump to a flow which will create a steady stream of bubbles in the BOD bottle, but not so great that solution droplets enter the tubing to the quartz cell.
4. If water vapor condenses in the quartz cell, heat the cell slightly above room temperature by wrapping it with a heating coil and attaching a variable transformer.
5. The bubbler consists of a glass tube with a bulb at the bottom, slightly above the bottom of the BOD bottle. The bulb contains several perforations to allow air to escape into the solution (in a stream of small bubbles). A second tube is provided to allow the exit of the vapor. The open end of the second tube is well above the surface of the liquid in the bottle. The two tubes are fixed into a stoppering device (preferably ground glass) which fits into the top of the bottle. A coarse glass frit can be used in place of the bulb on the first tube. However, it is more difficult to prevent contamination when a frit is used.
6. Replace the flexible tubing (Tygon or equivalent) used to connect the bubbler, cell, and pump periodically to prevent contamination due to adsorption of mercury.

## ATTACHMENT C

FIELD DATA SUMMARY SHEETS AND CHAIN OF CUSTODY FORMS



Figure 1 Air Data Sheet

Date 2/21/95Site Name Pyrid - 1 / <sup>JOB</sup> 17138Temperature (°F avg.) 35°FSampled By Suzanne MayHumidity (%) 100%Wind Direction N/ABarometric Pressure N/A

Sample No.	Location	Pump ID No.	Start Time (Hours)	Pump Rate (LPM)	Stop Time	Stop Reading	Total Liters
T3-A	Kitchen Floor By Sink (Vinyl Surface)	Pump #12	1336	4.50	1340	4.50	18.0
T3-B	Hallway Floor By Bathroom Door (Vinyl Surface)	Pump #12	1350	4.55	1354	4.40	17.9L
T3-C	Bathroom Wall Below Towel Rack (Wallpaper Surface)	Pump #12	1406	4.50	1410	4.50	18.0L
T5-A	Kitchen Floor By Sink + Dishwasher (Vinyl Surface)	Pump #12	1430	4.55	1434	4.50	18.1L
T5-B	Hallway Floor By Heating/Cooling Unit (Cork board Surface)	Pump #12	1444	4.45	1447	4.45	17.8L
T5-C	Bathroom Wall Above Toilet Paper Rack (Wallpaper Surface)	Pump #13	1455	4.50	1459	4.55	18.1L
TB-1	Trip Blank - Collected on Porch of Trailer #5 (Opened + Passed Thru Air)	N/A	1510	Q	1510	Q	Q
FB-1	Field Blank Worn during Sample Collection in Trailers #3 + #5	N/A	1325	Q	1500	Q	Q
LB-1	Lot Blanks Unopened Filters	N/A	0930	Q	0930	Q	Q

Comments (Rain, Damaged Pump, Etc.) \* Rain / Snow Outside Trailers #3 + #5

ate 2/27/95

Name Pyridium

Temperature (°F avg.) 30°F

ampled By Suzanne May

Humidity (%) N/A

ind Direction N/A

Barometric Pressure N/A

Sample No.	Location	Pump ID No.	Start Time (Hours)	Pump Rate (LPM)	Stop Time	Stop Reading	Total Liters
#1 4m 324-95	Kitchen Floor By Sink (Vinyl Surface) - (TRAILER #3)	#13	1510	4.50	1514	4.55	17.9
#2 4m 325-95	Hallway Floor By Bathroom Door (Vinyl Surface)	#13	1520	4.50	1530	4.55	18.2
#3 4m 326-95	Bathroom Wall Above Lamp Switch (Paper Surface)	#13	1540	4.55	1544	4.55	18.2
#4 4m 327-95	Kitchen Floor By Sink (Vinyl Surface) - (TRAILER #5)	#13	1600	4.50	1604	4.60	18.2
#5 4m 328-95	Hallway Floor By Heating/Cooling Unit (Vinyl Surface)	#13	1610	4.55	1614	4.75	18.6
#6 4m 329-95	Bathroom Wall Above Lamp Switch (Paper Surface)	#13	1620	4.55	1624	4.65	18.4

Comments (Rain, Damaged Pump, Etc.) Samples #1 - #3 were collected

from Trailer #3. Sample #4 - #6 were collected from

Trailer #5.

(914) 774-7894

PHONE NO.:

FAX (914) 774-2296

FM: K. Goisse / OHMPCS # 17138

P.O. # \_\_\_\_\_

Sample Number	Number of Containers	Description of Samples
1	1	37 mm 3PC filter for Hg Analysis, NIOSH 6809 - Surface Area - 0.0625 m <sup>2</sup> / Dust Particulate / Loading Contaminant (OHM-0324-95)
2	1	37 mm 3PC filter for Hg Analysis, NIOSH 6809, Surface Area - 0.0625 m <sup>2</sup> / Dust Particulate / Loading Contaminant (OHM-0325-95)
3	1	37 mm 3PC filter for Hg Analysis, NIOSH 6809, Surface Area - 0.0625 m <sup>2</sup> / Dust Particulate / Loading Contaminant (OHM-0326-95)
4	1	37 mm 3PC filter for Hg Analysis, NIOSH 6809, Surface Area - 0.0625 m <sup>2</sup> / Dust Particulate / Loading Contaminant (OHM-0327-95)
5	1	37 mm 3PC filter for Hg Analysis, NIOSH 6809, Surface Area - 0.0625 m <sup>2</sup> / Dust Particulate / Loading Contaminant (OHM-0328-95)
6	1	37 mm 3PC filter for Hg Analysis, NIOSH 6809, Surface Area - 0.0625 m <sup>2</sup> / Dust Particulate / Loading Contaminant (OHM-0329-95)

Person Assuming Responsibility for Sample:

Suzanne May

Time

Date

1630 2/27/95

Sample Number	Relinquished By:	Received By:	Time	Date	Reason for Change of Custody
ALL	<i>Suzanne May</i>				Laboratory Analysis.
Sample Number	Relinquished By:	Received By:	Time	Date	Reason for Change of Custody
Sample Number	Relinquished By:	Received By:	Time	Date	Reason for Change of Custody
Sample Number	Relinquished By:	Received By:	Time	Date	Reason for Change of Custody

ATTACHMENT D  
VACUUM SAMPLING ANALYTICAL RESULTS

PYRIDIUM MERCURY DISPOSAL SITE NO. 1  
VACUUM AIR SAMPLING ANALYTICAL RESULTS

Sample ID	Date Sampled	Sample Location	Mercury Mass (ug)	Dust Mass (mg)	Loading Contaminant (Hg Mass/Area +) (ug/m2)	Mercury Concentration (Hg Mass/Dust Mass) (ppm)
T3-A	02/21/95	Trailer #3: Kitchen Floor By Sink, (Vinyl Surface)	0.168	N/A	2.69	N/A
T3-B	02/21/95	Trailer #3: Hallway Floor By Bathroom Door (Vinyl Surface)	0.440	N/A	7.04	N/A
T3-C	02/21/95	Trailer #3: Bathroom Wall Below Towel Rack, (Paper Surface)	< 0.025 *	N/A	**	N/A
T5-A	02/21/95	Trailer #5: Kitchen Floor By Sink, (Vinyl Surface)	< 0.025 *	N/A	**	N/A
T5-B	02/21/95	Trailer #5: Hallway Floor By Heating/ Cooling Unit, (Corkboard Surface)	0.040	N/A	0.64	N/A
T5-C	02/21/95	Trailer #5: Bathroom Wall Above Toilet Paper Rack, (Paper Surface)	< 0.025 *	N/A	**	N/A
FB-1	02/21/95	Field Blank	< 0.025 *	N/A	**	N/A
TB-1	02/21/95	Trip Blank	< 0.025 *	N/A	**	N/A
LB-1	02/21/95	Lot Blank	< 0.025 *	N/A	**	N/A

+ Surface Area Vacuumed was 0.0625 m2, using a template 25 cm X 25 cm.

\* Mercury Mass Below Detection Limit of 0.025 ug for NIOSH 6009.

\*\* Not Calculated Because Mercury Mass is Below the Detection Limit.

PYRIDIUM MERCURY DISPOSAL SITE NO. 1  
VACUUM AIR SAMPLING ANALYTICAL RESULTS

100073

Sample ID	Date Sampled	Sample Location	Mercury Mass (ug)	Dust Mass (mg)	Loading Contaminant (Hg Mass/ Area +) (ug/m <sup>2</sup> )	Mercury Concentration (Hg Mass/ Dust Mass) (ppm)
# 1 (OHM-0324-95)	02/27/95	Trailer #3: Kitchen Floor By Sink, (Vinyl Surface)	0.473	19.43	7.59	24.3
# 2 (OHM-0325-95)	02/27/95	Trailer #3: Hallway Floor By Bathroom Door, (Vinyl Surface)	0.454	46.61	7.26	9.7
# 3 (OHM-0326-95)	02/27/95	Trailer #3: Bathroom Wall Above Light Switch, (Paper Surface)	< 0.025 *	N/A	**	**
# 4 (OHM-0327-95)	02/27/95	Trailer #5: Kitchen Floor By Sink, (Vinyl Surface)	< 0.025 *	N/A	**	**
# 5 (OHM-0328-95)	02/27/95	Trailer #5: Hallway Floor By Heating/ Cooling Unit, (Corkboard Surface)	0.112	42.14	1.79	2.5
# 6 (OHM-0329-95)	02/27/95	Trailer #5: Bathroom Wall Above Light Switch, (Paper Surface)	< 0.025 *	N/A	**	**

+ Surface Area Vacuumed was 0.0625 m<sup>2</sup>, using a template 25 cm X 25 cm.

\* Mercury Mass Below Detection Limit of 0.025 ug for NIOSH 6009.

\*\* Not Calculated Because Mercury Mass is Below the Detection Limit.



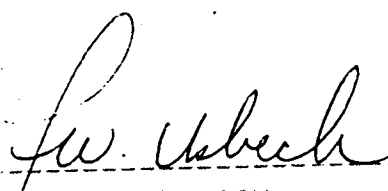
CHM CORP. PROJ.#17138  
ACCTS. PAYABLE  
200 HORIZON CENTER BLVD.  
TRENTON, NJ 08650  
Attention: S. MAY/K.GOISSE

Work Order Number: R022395-004  
Sample Received: 02/23/95  
Report Date: 02/23/95

Project: JOB #17138

MDS Number	Client Number	Results	Concentration
195-0223-008 1. MERCURY	T3-A	Air vol: 18.0 L 0.168 ug	9.333 ug/m3
195-0223-009 1. MERCURY	T3-B	Air vol: 17.9 L 0.440 ug	24.581 ug/m3
195-0223-010 1. MERCURY	T3-C	Air vol: 18.0 L < 0.025 ug	< 1.389 ug/m3
195-0223-011 1. MERCURY	T5-A	Air vol: 18.1 L < 0.025 ug	< 1.381 ug/m3
195-0223-012 1. MERCURY	T5-B	Air vol: 17.8 L 0.040 ug	2.247 ug/m3
195-0223-013 1. MERCURY	T5-C	Air vol: 18.1 L < 0.025 ug	< 1.381 ug/m3
195-0223-014 1. MERCURY	BLANK-TB-1	< 0.025 ug	N/A

Analytical Method: NIOSH-6009  
Detection Limit: 0.025 ug

Reviewed by: 

Fred Usbeck, CIH  
Laboratory Director



OF CORP. PROJ.#17138  
ACCTS. PAYABLE  
200 HORIZON CENTER BLVD.  
TRENTON, NJ 08650  
Attention: S. MAY/K.GOISSE

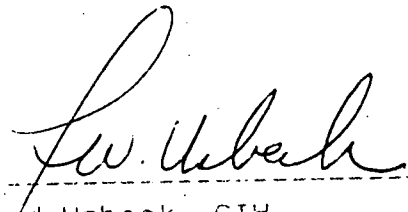
Work Order Number: R022395-004  
Sample Received: 02/23/95  
Report Date: 02/23/95

Project: JOB #17138

MDS Number	Client Number	Results	Concentration
195-0223-015	BLANK-FB-1		
1. MERCURY		< 0.025 ug	N/A
195-0223-016	BLANK-LB-1		
1. MERCURY		< 0.025 ug	N/A

Analytical Method: NIOSH 6009  
Detection Limit: 0.025 ug

Reviewed by: \_\_\_\_\_

  
Fred Usbeck, CIH  
Laboratory Director





MDS  
Laboratories

# LABORATORY REPORT

100076

INDUSTRIAL HYGIENE

ENVIRONMENTAL TESTING

- EPA/NVLAP 1262
- AIHA ACCREDITATION NO. 135

- NY DOH 10903
- PA DER 06-353

- NJ DEP 77678

Work Order Number: R022395-008  
Sample Received: 02/23/95  
Report Date: 02/27/95

OHM CORP. PROJ.#17138  
ATTN: KEITH GOISSE  
200 HORIZON CENTER BLVD.  
TRENTON, NJ 08691  
Attention: S. MAY/K.GOISSE

P.O. Number: 1000336

Project: 17138

MDS Client  
Number Number

Results

Concentration

I95-0223-030 T3-A  
1. TOTAL POSTWEIGHT

Air vol: 18.0 L  
34.18 mg

N/A

I95-0223-031 T3-B  
1. TOTAL POSTWEIGHT

Air vol: 17.9 L  
92.65 mg

N/A

I95-0223-032 T3-C  
1. TOTAL POSTWEIGHT

Air vol: 18.0 L  
31.28 mg

N/A

I95-0223-033 T5-A  
1. TOTAL POSTWEIGHT

Air vol: 18.1 L  
38.63 mg

N/A

I95-0223-034 T5-B  
1. TOTAL POSTWEIGHT

Air vol: 17.8 L  
40.70 mg

N/A

I95-0223-035 T5-C  
1. TOTAL POSTWEIGHT

Air vol: 18.1 L  
33.36 mg

N/A

I95-0223-036 BLANK-TB-1  
1. TOTAL POSTWEIGHT

33.40 mg

N/A

Analytical Method: NIOSH 0500/0600  
Detection Limit: 0.10 mg

Reviewed by: \_\_\_\_\_

*Fred Usbeck*  
Fred Usbeck, CIH  
Laboratory Director



MDS  
Laboratories

# LABORATORY REPORT 100077

INDUSTRIAL HYGIENE

ENVIRONMENTAL TESTING

- EPA/NVLAP 1262
- AIHA ACCREDITATION NO. 135

- NY DOH 10903
- PA DER 06-353

- NJ DEP 77678

OHM CORP. PROJ.#17138  
ATTN: KEITH GOISSE  
200 HORIZON CENTER BLVD.  
TRENTON, NJ 08691  
Attention: S. MAY/K.GOISSE

Work Order Number: R022395-008  
Sample Recieved: 02/23/95  
Report Date: 02/27/95

P.O. Number: 1000336  
Project: 17138

MDS Number	Client Number
---------------	------------------

Results

Concentration

I95-0223-037 BLANK-FB-1

1. TOTAL POSTWEIGHT

30.83 mg

N/A

I95-0223-038 BLANK-LB-1

1. TOTAL POSTWEIGHT

36.59 mg

N/A

Analytical Method: NIOSH 0500/0600  
Detection Limit: 0.10 mg

Reviewed by: \_\_\_\_\_

  
Fred Usbeck, CIH  
Laboratory Director



MDS  
Laboratories

# LABORATORY REPORT 100078

INDUSTRIAL HYGIENE

ENVIRONMENTAL TESTING

- EPA/NVLAP 1262
- AIHA ACCREDITATION NO. 135

- NY DOH 10903
- PA DER 06-353

- NJ DEP 77678

OHM CORP. PROJ.#17138  
ATTN: KEITH GOISSE  
200 HORIZON CENTER BLVD.  
TRENTON, NJ 08691  
Attention: S. MAY/K. GOISSE

Work Order Number: R030295-003  
Sample Recieved: 03/02/95  
Report Date: 03/06/95

P.O. Number: 1000336  
Project: 17138

MDS Client  
Number Number

Results

Concentration

I95-0302-011 OHM-0324-95  
1. MERCURY

0.473 ug

N/A

I95-0302-012 OHM-0325-95  
1. MERCURY

0.454 ug

N/A

I95-0302-013 OHM-0326-95  
1. MERCURY

< 0.025 ug

N/A

I95-0302-014 OHM-0327-95  
1. MERCURY

< 0.025 ug

N/A

I95-0302-015 OHM-0328-95  
1. MERCURY

0.112 ug

N/A

I95-0302-016 OHM-0329-95  
1. MERCURY

< 0.025 ug

N/A

Analytical Method: NIOSH 6009  
Detection Limit: 0.025 ug

Reviewed by: \_\_\_\_\_

  
Fred Usbeck, CIH  
Laboratory Director



MDS  
Laboratories

# LABORATORY REPORT 100079

INDUSTRIAL HYGIENE

ENVIRONMENTAL TESTING

- EPA/NVLAP 1262
- AIHA ACCREDITATION NO. 135

- NY DOH 10903
- PA DER 06-353

- NJ DEP 77678

OHM CORP. PROJ.#17138  
ATTN: KEITH GOISSE  
200 HORIZON CENTER BLVD.  
TRENTON, NJ 08691  
Attention: S. MAY/K.GOISSE

Work Order Number: R030295-002  
Sample Recieved: 03/02/95  
Report Date: 03/03/95

P.O. Number: 1000336

Project: 17138

MDS Client  
Number Number

Results

Concentration

I95-0302-005 OHM-0324-95

1. DUST, TOTAL/RESPIRABLE

19.43 mg

N/A

N/A

I95-0302-006 OHM-0325-95

1. DUST, TOTAL/RESPIRABLE

46.61 mg

N/A

N/A

I95-0302-007 OHM-0326-95

1. DUST, TOTAL/RESPIRABLE

0.23 mg

N/A

N/A

I95-0302-008 OHM-0327-95

1. DUST, TOTAL/RESPIRABLE

3.21 mg

N/A

N/A

I95-0302-009 OHM-0328-95

1. DUST, TOTAL/RESPIRABLE

43.14 mg

N/A

N/A

I95-0302-010 OHM-0329-95

1. DUST, TOTAL/RESPIRABLE

0.12 mg

N/A

N/A

Analytical Method: NIOSH 0500/0600

Detection Limit: 0.10 mg

Reviewed by: \_\_\_\_\_

*Fred Usbeck*  
Fred Usbeck, CIH  
Laboratory Director



MDS  
Laboratories

# LABORATORY REPORT

100080

INDUSTRIAL HYGIENE

ENVIRONMENTAL TESTING

- EPA/NVLAP 1262
- AIHA ACCREDITATION NO. 135

- NY DOH 10903
- PA DER 06-353

- NJ DEP 77678

OHM CORP. PROJ.#17138  
ATTN: KEITH GOISSE  
200 HORIZON CENTER BLVD.  
TRENTON, NJ 08691  
Attention: S. MAY/K.GOISSE

Work Order Number: R022795-014  
Sample Recieved: 02/27/95  
Report Date: 02/27/95

P.O. Number: 1000336

MDS Number	Client Number	Results	Concentration
I95-0227-072	OHM-0324-95		
1. PVC FILTER PREWEIGHT		12.15 mg	N/A
I95-0227-073	OHM-0325-95		
1. PVC FILTER PREWEIGHT		11.72 mg	N/A
I95-0227-074	OHM-0326-95		
1. PVC FILTER PREWEIGHT		11.77 mg	N/A
I95-0227-075	OHM-0327-95		
1. PVC FILTER PREWEIGHT		12.05 mg	N/A
I95-0227-076	OHM-0328-95		
1. PVC FILTER PREWEIGHT		11.96 mg	N/A
I95-0227-077	OHM-0329-95		
1. PVC FILTER PREWEIGHT		12.02 mg	N/A

Analytical Method: NIOSH 0500/0600  
Detection Limit: 0.10 mg

Reviewed by: \_\_\_\_\_

*Fred Usbeck*  
Fred Usbeck, CIH  
Laboratory Director

ATTACHMENT E  
ATSDR RECORD OF ACTIVITY

March 27, 95  
12:05 AM

\*\*\* ATSDR Regional Information System 2.2 \*\*\*  
- RECORD OF ACTIVITY -

PAGE 1

- Author Information -

Author: Steven Jones  
User ID: SXJ6

Action Date: 03/24/95  
Time: 05:00 PM

- Site Specific Information -

Name: PYRIDIDIUM MERCURY DISPOSAL  
Address: ROUTE 17M City: HARRIMAN  
County: ORANGE State: NY Zip Code:  
CERCLIS #: CRS #: 20EV Region: 02 Congr. District: 00

- Site Status -

(1): NPL X Non-NPL RCRA Non-Site Specific SACM Federal\*  
(2): Emergency Response Remedial X Removal Other:

- Activities -

Incoming Call	Public Meeting*	1 Health Consult*	Site Visit*
Outgoing Call	Other Meeting	Health Referral	Info Provided
Confrence Call	1 Data Review	Written Respons	Training
Incoming Mail	Other Activity:		

- Requestor and Affiliation -

Requestor: DAN HARKAY  
Affiliation: EPA, OSC  
Work Phone: (908)321-6614  
Address:

Other Phone: ( ) -

County:

Congressional District: 00

- Contacts and Affiliations -

MARK MADDALONI

PAT FRITZ

BUCK GRISSOM

MARK VAN VALKENBERG

EPA, RISK ASSESSOR  
STATE HEALTH, NYSDOH  
ATSDR, EICB  
STATE HEALTH, NYSDOH

Program Area: Health Consult

Enclosures: N

CC: A. Block  
G. Buynoksi  
B. Grissom

M. Van Valkenberg  
P. Fritz  
M. Maddaloni

1 3, 95

\*\*\* ATSDR Regional Information System 2.2 \*\*\*

PAGE 2

23 AM

- RECORD OF ACTIVITY -

PYRIDINIUM MERCURY DISPOSAL

Action Date: 03/24/95

- Narrative Summary -

The USEPA has requested that ATSDR review analytical data collected from the interiors of two single family trailer homes. These trailer homes were located in a trailer park built on a former inorganic mercury (mercuric sulfide) disposal area in the Village of Harriman, NY. Five trailer homes were originally located on the Pyridium Mercury Disposal site, all of which have been relocated. Two of the trailers (designated #3 and #5) were thoroughly cleaned, since they would be reinhabited. The interiors were subsequently sampled to confirm that the cleaning was performed adequately as to protect the health of future inhabitants.

Interior confirmation sampling was performed using a Gilliam pump. The procedure is to slowly run the vacuum for several minutes over a specified surface area (in this case 25 sq. cm.) from the interior of the home. The pump collects particles on a filter which is then analyzed in the laboratory. A concentration of mercury was determined using the mass of mercury detected per the total mass of particulates vacuumed. Additionally, a mass of mercury per unit area was determined.

In trailer #3, samples were taken from the kitchen floor by the sink (vinyl surface), the hallway floor by the bathroom (vinyl surface), and the bathroom wall (paper surface). In trailer #5, samples were taken from the kitchen floor (vinyl surface), the hallway floor by a heating/cooling unit (corkboard surface), and the bathroom wall (paper surface).

The highest levels of mercury were detected in trailer #3. In the sample from the kitchen, the mass of mercury was 7.568 ug/sq. meter and the mass of dust was 310.9 mg/sq. meter (24.3 mg Hg/kg dust). For the hallway sample, the mass of mercury was 7.264 ug/sq. meter and the mass of dust was 745.8 mg/sq. meter (9.7 mg Hg/kg dust).

- Action Required/Recommendations/Info Provided -

The primary route of exposure would be ingestion of mercury contaminated interior dust. The levels of mercury detected in trailers #3 and #5 are below levels of health concern.

Signature: STJDate: 4/3/95Concurrence: Kenneth G. OrloffDate: 4/3/95



SAMPLING REPORT  
EXTENT OF CONTAMINATION STUDY

PYRIDIDIUM MERCURY DISPOSAL SITE NO. 1  
VILLAGE OF HARRIMAN  
ORANGE COUNTY, NEW YORK

JUNE 1996

Prepared by:

U.S. Environmental Protection Agency  
Region II Removal Action Branch  
Eric Wilson, On-Scene Coordinator

Roy F. Weston, Inc.  
Superfund Technical Assessment and Response Team  
Kathy Campbell, Project Manager

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Figure 2	Mercury Concentration Map - October and December 1994 Sampling Events
Figure 3	Extent of Mercury Contamination Map

## APPENDICES

A.	Results of Soil Sampling - October 1994
B.	Soil Sampling SOP #2012
C.	Borehole Logs
D.	USEPA ERT/REAC Spectrace 2000 XRF SOP
E.	XRF Data
F.	XRF Log Entries
G.	Soil Boring Cross Sections
H.	Calculation of the Quantity of Contaminated Soil
I.	NIST Certificate of Analysis for Standard Reference Material 2709

## 1. INTRODUCTION

### 1.1 Site Background

The Pyridium Mercury Disposal Site (Site) is a mobile home park located on the south corner of the intersection of State Route 17M and Harriman Heights Road (County Route 71) in the Village of Harriman, Orange County, New York.

A white clay-like material was discovered at the Site during an investigation at the adjacent transmission shop. Samples collected by the New York State Department of Environmental Conservation (NYSDEC) and New York State Department of Health (NYSDOH) were found to contain mercury at concentrations ranging from less than 1 mg/kg to 653 mg/kg.

Mercury contamination at the Site is suspected to be the result of the use of a mercury-contaminated industrial waste to fill a wetland area on which the mobile home park was built.

In October 1994, the Roy F. Weston Technical Assistance Team (TAT) conducted a study to determine the nature and horizontal extent of contamination in surface soils at the Site. Surface soils (0-6") were screened in-situ using an X-Ray Fluorescence Analyzer (XRF). Eleven confirmation samples were analyzed for total mercury by mercury cold vapor atomic absorption (AA). The XRF and laboratory analytical results of the surface soil sampling are presented in Figure 1 and Appendix A.

Samples of the waste material were collected and analyzed to speciate the mercury and determine toxicity using the toxicity characteristic leachate procedure (TCLP). The waste was determined to be a chemical substrate contaminated with a mercuric or mercurous salt. Results of TCLP analysis were below the regulatory limits for all analytes. Based on this analysis, the waste was determined not to exhibit the characteristic of toxicity as defined in the Resource Conservation and Recovery Act (RCRA).

### 1.2 Sampling Objective

The U.S. Environmental Protection Agency (EPA) Region II On-Scene Coordinator (OSC) tasked TAT with conducting a study to determine the vertical and horizontal extent of mercury contamination at the Site.

## 2. METHODOLOGY

### 2.1 Sampling Summary

The EPA Environmental Response Team (ERT) and the Response Engineering and Analytical Contractor (REAC) assisted in the study by providing personnel and equipment for collection of subsurface soil samples. TAT provided personnel, equipment and resources for documentation of the sampling event and analysis of samples.

The sampling was conducted on December 6, 1994. Eleven soil borings were advanced to a maximum depth of 12 feet using a Geoprobe®. A total of 13 samples were screened for mercury using the XRF.

### 2.2 Soil Sampling

Soil borehole locations were selected based on the results of the extent of contamination study conducted in October 1994.

Soil sampling was conducted in accordance with Soil Sampling SOP #2012 (Appendix B). Soils samples were collected using 2-inch diameter split spoons, lined with acetate sleeves. The acetate sleeves were used to facilitate sample recovery and reduce the potential for cross contamination of samples. The split spoons were advanced and recovered using a truck-mounted hydraulic ram (Geoprobe®). The soils at each borehole location were described by the Project Geologist. These borehole logs are included as Appendix C.

### 2.3 XRF Field Screening for Metals

Samples of soils directly underlying layers containing visible waste were selected for XRF screening to delineate the vertical extent of mercury contamination. Sample preparation and XRF analysis were conducted in accordance with USEPA ERT/REAC Spectrace 9000 XRF SOP (Appendix D).

Samples were homogenized, dried, sifted using a #20 mesh sieve, and placed in sample cups. Samples were screened for metals using Spectrace Model 9000 XRF. Source measuring times used for analysis were 1000 seconds for the Cadmium 109 (Cd109), 10 seconds for Iron 55 (Fe55), and 10 seconds for Americium 241 (Am241). The measuring time for the Cd109 source was maximized in order to minimize the detection limit for mercury. The elements detected using the Fe55 and Am241 sources were not required for this investigation. The measuring times for these sources were minimized to reduce the time required for analysis.

Results for all 26 elements analyzed were stored in the instrument's internal memory; this data was downloaded to a computer data file for further processing. The downloaded data is presented in Appendix E. Instrument calibration and mercury results were also recorded in the instrument log book. The logbook entries are presented in Appendix F.

## **2.4 Field Screening for Organic Compounds**

All soil samples were field screened for organic compounds using a photo-ionization detector (PID). The PID was calibrated for benzene using an isobutylene/air mixture. Calibration to benzene gives a 1:1 meter response for benzene. This does not limit the detection of other organic compounds, however meter response may not be 1:1.

## **3. RESULTS**

### **3.1 XRF Results**

The results of XRF analysis and sample descriptions are presented in Table 1 and Figure 2. A discussion of the October 1994 sampling results is included in the Sampling Report dated October 1994. The MDL and MQL for this sampling event were calculated to be 24 and 80 milligrams per kilogram (mg/kg), respectively (Table 2).

### **3.2 PID Results**

The results of PID screening of soils for organic compounds were recorded on the borehole logs by the Project Geologist. The borehole logs are included as Appendix C.

## **4. DISCUSSION OF RESULTS**

### **4.1 PID Results**

Elevated concentrations of organic vapors were detected in boreholes E90 and G170. A PID reading of 30 parts per million benzene equivalents (ppm) was detected from a sample collected from borehole E90 at a depth of 4 to 8 feet. PID readings of 5 and 7 ppm were detected from the screening of samples collected from borehole G170 at depths of 4 to 8 feet and 8 to 12 feet, respectively.

Groundwater was encountered at the base of each of these boreholes. Elevated PID readings in the unsaturated zone above the groundwater interface indicate the possibility of contamination of soil and groundwater with organic compounds.

#### 4.2 Extent of Mercury Contamination

At borehole G70, mercury was detected at a concentration of 168 mg/kg at a depth of 1.5 feet. The vertical extent of contamination was not defined at this location. Borehole G70 is situated in the wetlands area located southeast of the waste disposal area. Surface water runoff from the site drains to these wetlands. No visible waste was observed in borehole G70, therefore, it is believed that contamination in this area is the result of contaminant migration via surface water runoff. Previous analysis has shown that the mercury in the waste is not water soluble, therefore it is believed that contamination in the wetlands is limited to surface soils (i.e., less than 2 feet in depth).

At borehole G170, waste was observed at a depth of 0.25 to 2.5 feet. Mercury was detected at an estimated concentration of 67 mg/kg in sample G170-4 collected at a depth of 4 feet below ground surface. The mercury concentration in sample G170-6.5 collected at a depth of 6.5 feet was determined to be less than the instrument MDL. The vertical extent of contamination at this location has been established.

With the exception of samples G70-1.5 and G170-4, discussed previously, the mercury concentrations in all screened samples were determined to be below the instrument MDL of 24 mg/kg. The vertical limit of mercury contamination was defined at all borehole locations, except G70. The limit of contamination adopted for this study is the instrument MDL of 24 mg/kg.

Waste was observed at borehole locations BB, DD, D130, E90, E210 and G170. Boring cross sections for Sample Lines B, D, E and G are included in Appendix D. The extent of mercury contamination has been mapped and is presented in Figure 3. Mercury contamination at the site encompasses approximately 24,000 square feet. The volume of contaminants has been calculated to be approximately 4,000 cubic yards. Volume calculations are included as Appendix H.

#### 5. **RECOMMENDATIONS**

It is recommended that appropriate actions be taken to protect the local population from exposure to mercury-contaminated material found at the site. The observed hydrocarbon contamination at boreholes E90 and G170 should be investigated to determine what effect it may have on remediation options.

TABLES

TABLE 1  
Results of XRF Screening for Mercury  
Sampling Conducted December 6, 1994

Sample Number	Boring Location	Sample Depth (feet)	Mercury Conc. (mg/kg)	Sample Description
B70-3	B70	3	ND <sup>1</sup>	Yellowish brown silt & clay, little fine sand, trace organic material
B130-1	B130	1	ND	Yellowish brown silt & fine to coarse sand
B160-1	B160	1	ND	Dark brown organic silt, trace white material, rock fragments, organic debris
BB-2	BB	2	ND	Dark yellowish brown silt, trace clay & fine sand, moist
D130-7	D130	7	ND	Dark brown organic silt (wetlands material), trace white flakes
D190-2	D190	2	ND	Strong brown fine sand & silt, moist
DD-5.5	DD	5.5	ND	Very dark brown organic silt (wetlands material) roots present, dry
E90-7	E90	7	ND	Black organic silt, divided by layer of white product
E210-1.5	E210	1.5	ND	Strong brown fine sand & silt, trace clay, rock frags & debris, moist
G70-0.5	G70	0.5	ND	Dark brown silt & fine sand, roots and rock frags present, moist
G70-1.5	G70	1.5	168	Dark brown silt & med. to coarse sand, trace fine sand present, roots
G170-4	G170	4	67 B <sup>2</sup>	Yellowish brown silt & clay, trace fine sand, rock fragments
G170-6.5	G170	6.5	ND	Gray medium to fine sand & silt, moist

<sup>1</sup> ND indicates that the analyte was not detected above the instrument detection limit of 24 mg/kg.

<sup>2</sup> B indicates that the analyte was detected at a concentration greater than the instrument detection limit of 24 mg/kg and less than the instrument quantitation limit of 80 mg/kg. Concentrations are estimated. ((0))



TABLE 2  
Results of XRF Analysis of NIST Standard 2709  
and Calculation of MDL and MQL

Sample Number	Analysis Date	Analysis Time	Measured Mercury Concentration (mg/kg)
NIST 2709	12/6/94	13.87	-17.1
NIST 2709	12/6/94	15.10	-26.7
NIST 2709	12/6/94	17.96	-21.1
NIST 2709	12/7/94	9.18	-11.5
NIST 2709	12/7/94	9.51	-18.3
NIST 2709	12/7/94	11.69	-35.6
NIST 2709	12/7/94	12.06	-12.6
NIST 2709	12/7/94	14.47	-23.3

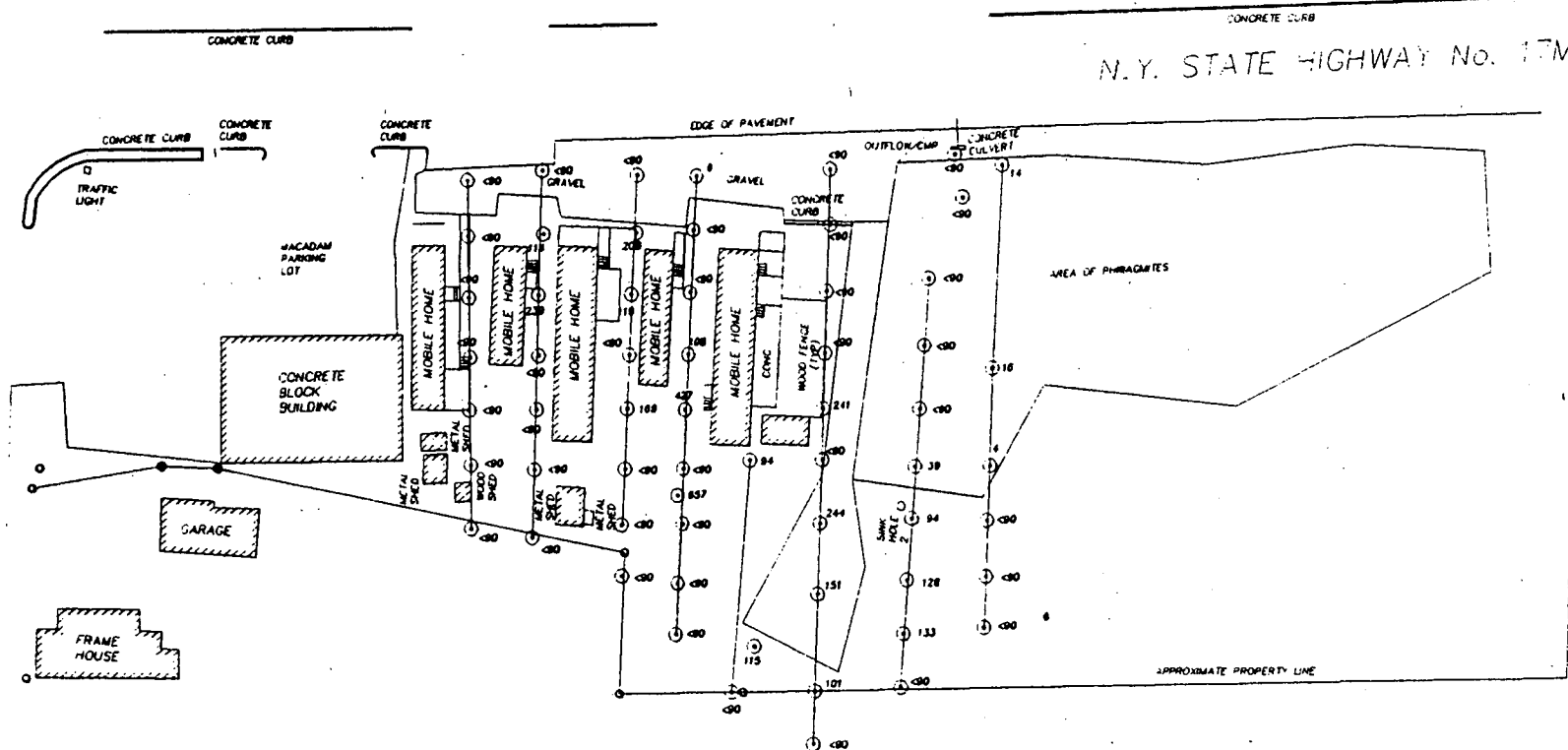
Population Standard Deviation =  $O_{n-1} = [(\sum x_i^2 - (\sum x_i)^2/n) / (n-1)]^{1/2} = 8$

Method Detection Limit =  $3[O_{n-1}] = 24$

Method Quantitation Limit =  $10[O_{n-1}] = 80$

**FIGURES**

COUNTY HIGHWAY 71



**LEGEND:**

- Sample Location
- 100 Estimated Mercury concentration (mg/kg)
- <90 Mercury concentration less than 90mg/kg

SCALE 1" = 40'

FIGURE 1 - MERCURY CONCENTRATION MAP

PYRIDIUM MERCURY DISPOSAL SITE NO. 1

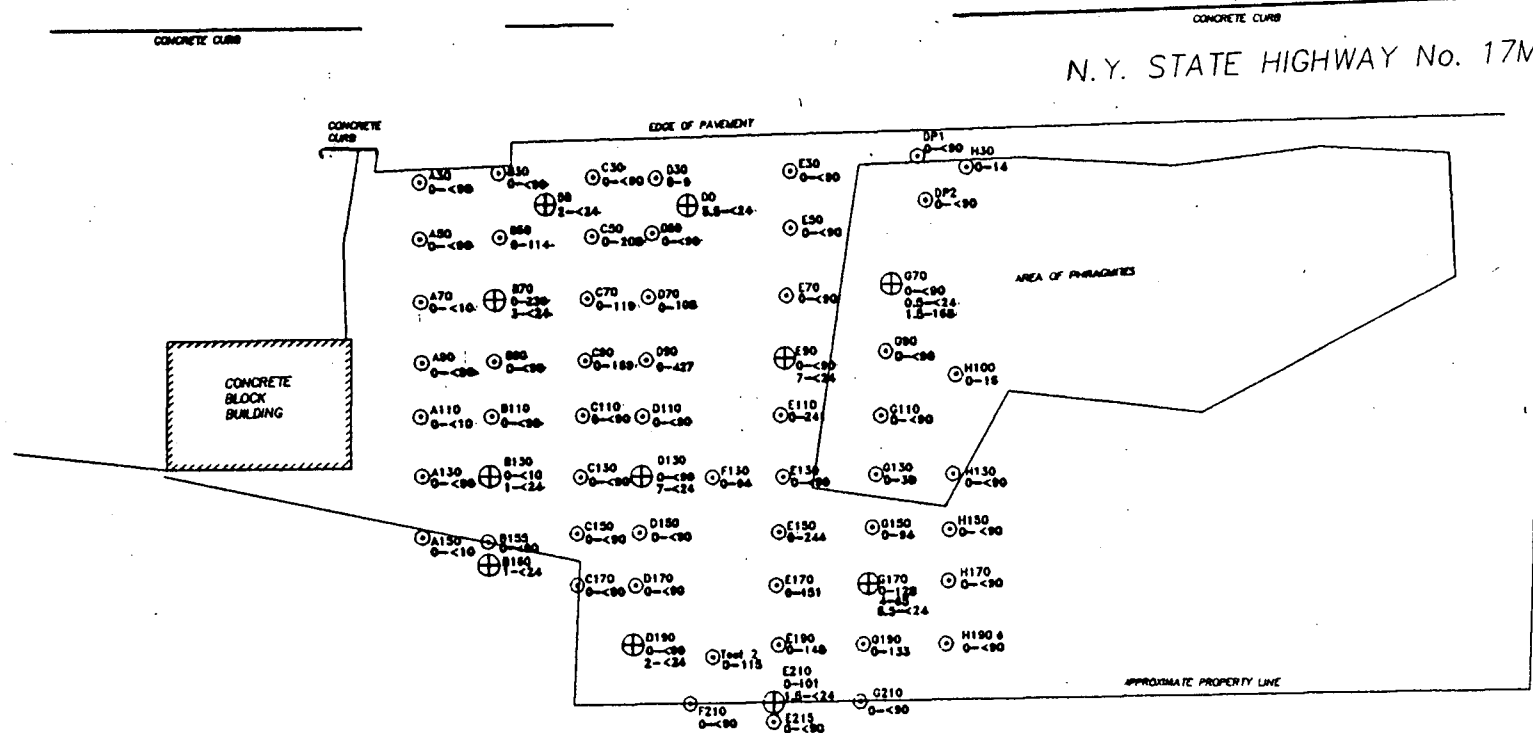
OCTOBER - 1994

HARRISMAN, NEW YORK

D:\PYRID6A.DWG

100094

COUNTY HIGHWAY 71



LEGEND

- Surface Sample Location (10\94)
- ⊕ Borehole Sample Location (12\94)
- 0100 Sampling Location Designation
- 0-100 Sample Depth (Feet) - Concentration (ng/kg)

SCALE 1" = 40'

FIGURE 2 - MERCURY CONCENTRATION MAP

PYRIDIUM MERCURY DISPOSAL SITE No. 1

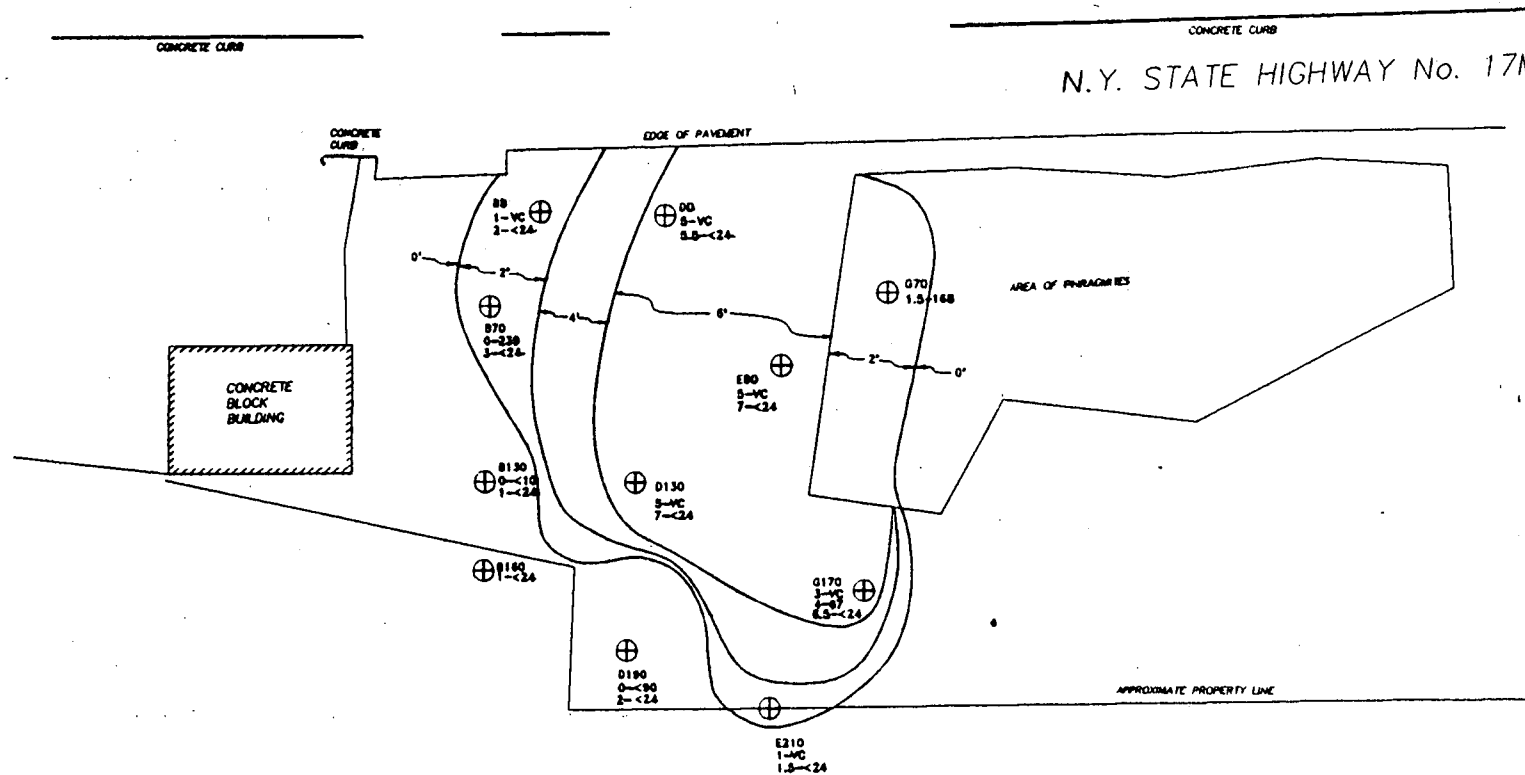
SAMPLING CONDUCTED 10\94 & 12\94

HARRIMAN, NEW YORK

D: VPIR08ALD00

100095

COUNTY HIGHWAY 71



LEGEND:

- ⊕ Borehole Location
- G170 Borehole Location Designation
- VC Visible Contamination
- 3 Observation / Sample Depth (feet)
- 87 Mercury Concentration (ng/kg)
- ~ Depth of Contamination

SCALE 1" = 40'

FIGURE 3 - EXTENT OF CONTAMINATION MAP

PYRIDIUM MERCURY DISPOSAL SITE No. 1

SAMPLING CONDUCTED 10/94 & 12/94

HARRIMAN, NEW YORK

D:\PYRID09.DWG

100096

APPENDIX A

RESULTS OF SOIL SAMPLING - OCTOBER 1994

Table A1  
XRF Screening Location Descriptions  
Pyridium Mercury Disposal Site No. 1 - Harriman NY  
October 1994

SAMPLE ID	MERCURY CONC. (mg/kg)	DESCRIPTION
A30	<90	Brown coarse soil & gravel fill 0-6".
A50	<90	Brown coarse soil fill 0-6".
A70	<90	Brown organic topsoil 0-6".
A90	<90	Brown organic topsoil 0-6".
A110	<90	Brown organic topsoil 0-6".
A130	<90	Brown organic topsoil 0-6".
A150	<90	Brown organic topsoil 0-6".
B30	<90	Brown coarse soil & gravel fill 0-6".
B50	114B	White clay-like material visible at 3".
B70	239B	White clay-like material visible at 3".
B90	<90	Brown organic silt 0-6".
B110	<90	Brown organic silt and sand fill 0-6".
B130	<90	Brown organic silt and sand fill 0-6".
B155	<90	Brown organic silt 0-6".
C30	<90	Brown coarse soil and gravel fill 0-6".
C55	208B	White clay-like material visible at 6".
C70	19B	White clay-like material mixed with brown organic silt 0-6".
C90	<90	White clay-like material mixed with brown organic silt 0-6".
C110	<90	White clay-like material at 6".
C130	<90	White clay-like material at 6".
C130R	<90	White clay-like material at 6".

Table A1  
XRF Screening Location Descriptions  
Pyridium Mercury Disposal Site No. 1 - Harriman NY  
October 1994

SAMPLE ID	MERCURY CONC. (mg/kg)	DESCRIPTION
C150	<90	White clay-like material at 6".
C170	<90	Brown organic silt and sand 0-6".
D30	<90	Brown coarse soil and gravel fill 0-6".
D50	<90	Brown organic silt mixed with trace quantities of white clay-like material 0-6".
D70	<90	Brown organic silt mixed with white clay-like material 0-6".
D90	<90	White clay-like material mixed with brown organic silt 0-6".
D110	227B	White clay-like material mixed with brown organic silt 0-6".
D130	<90	Brown organic silt and fine sand fill 0-6".
D150	<90	Brown organic silt 0-6".
D170	<90	Brown organic silt mixed with debris 0-6".
D190	<90	Brown organic silt 0-6".
E30	<90	Brown coarse soil and gravel 0-6".
E50	<90	Brown organic silt and gravel 0-6".
E70	<90	Brown organic silt and fine sand mixed with white clay-like material 0-6".
E90	<90	Brown organic silt and fine sand mixed with white clay-like material 0-6".
E110	241B	Brown organic silt mixed with white clay-like material 0-6".
E130	<90	Brown organic silt mixed with woodchips, gravel and some black ash 0-6".



Table A1  
XRF Screening Location Descriptions  
Pyridium Mercury Disposal Site No. 1 - Harriman NY  
October 1994

SAMPLE ID	MERCURY CONC. (mg/kg)	DESCRIPTION
E150	244B	Surface brown organic silt mixed with woodchips and gravel. White clay-like material present below surface.
E170	151B	Brown organic silt. White clay-like material present at surface.
E190	148B	Brown organic silt mixed with woodchips. White clay-like material present at 3".
E210	101B	Brown organic silt mixed with woodchips. White clay-like material present at 3".
E215	<90	Brown organic silt 0-6". On slope of hill.
F130	94B	White clay-like material present just below turf.
F210	<90	Brown organic silt 0-6".
G70	<90	Brown organic silt 0-6". Wetland area.
G90	<90	Brown organic silt 0-6". Wetland area.
G110	<90	Brown organic silt 0-6". Wetland area.
G130A	<90	Brown organic silt and fine sand mixed with trace light-colored material 0-6". Purposefully concentrated for analysis.
G130B	120B	Organic silt. Analysis of surface soils.
G150	95B	White clay-like material taken from sinkhole 0-12".
G170	128B	White clay-like material present at 6".
G190	134B	White clay-like material present at 6".

Table A1  
XRF Screening Location Descriptions  
Pyridium Mercury Disposal Site No. 1 - Harriman NY  
October 1994

SAMPLE ID	MERCURY CONC. (mg/kg)	DESCRIPTION
G210	<90	Brown organic silt 0-6". Analysis of surface soils.
H30	<90	Brown organic silt 0-6". Sample dried and analyzed in cup.
H100	<90	Brown organic silt 0-6".
H130	<90	Brown organic silt 0-6".
H150	<90	Brown organic silt 0-6".
H170	<90	Brown organic silt 0-6".
H190	<90	Brown organic silt 0-6".
Test 1	<90	White clay-like material taken from sink hole at D150.
Test 2	128B	White clay-like material found at ground surface at F190.
DP-1	<90	Brown organic silt and gravel 0-3". Sample collected in drainage path below water line, dried and analyzed in cup.
DP-2	<90	Brown organic silt and gravel 0-3". Sample collected in dry section of intermittent drainage path, dried and analyzed in cup.

Note: B - Analyte detected above method detection limit of 92 mg/kg and less than method quantitation limit of 306 mg/kg. Concentrations are estimated.

Table A2  
Mercury Concentration by Mercury Cold Vapor Atomic Absorption  
Pyridium Mercury Disposal Site No. 1 - Harriman NY  
October 1994

Sample ID	Mercury Concentration (mg/kg)
C130-R	169.0
D30	8.80
D90	108.0
D110	427.0
G130-B	38.9
H30	13.7
H100	15.9
H130	3.74
SD-1	0.643
Test-1	657.0
Test-2	115.0

APPENDIX B

SOIL SAMPLING SOP #2012

## 2.0 SOIL SAMPLING: SOP #2012

## 2.1 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to describe the procedures for collecting representative soil samples. Analysis of soil samples may determine whether concentrations of specific soil pollutants exceed established action levels, or if the concentrations of soil pollutants present a risk to public health, welfare, or the environment.

## 2.2 METHOD SUMMARY

Soil samples may be collected using a variety of methods and equipment. The methods and equipment used are dependent on the depth of the desired sample, the type of sample required (disturbed versus undisturbed), and the type of soil. Near-surface soils may be easily sampled using a spade, trowel, and scoop. Sampling at greater depths may be performed using a hand auger, a trier, a split-spoon, or, if required, a backhoe.

## 2.3 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Chemical preservation of solids is not generally recommended. Refrigeration to 4°C, supplemented by a minimal holding time, is usually the best approach.

## 2.4 INTERFERENCES AND POTENTIAL PROBLEMS

There are two primary interferences or potential problems associated with soil sampling. These include cross-contamination of samples and improper sample collection. Cross-contamination problems can be eliminated or minimized through the use of dedicated sampling equipment. If this is not possible or practical, then decontamination of sampling equipment is necessary. Improper sample collection can involve using contaminated equipment, disturbance of the matrix resulting in compaction of the sample, or inadequate homogenization of the samples where required, resulting in variable, non-representative results.

## 2.5 EQUIPMENT/APPARATUS

- safety equipment, as specified in the health and safety plan
- compass
- tape measure
- survey stakes or flags
- camera and film
- stainless steel, plastic, or other appropriate homogenization bucket or bowl
- 1-quart mason jars w/Teflon liners
- Ziploc plastic bags
- logbook
- labels
- chain of custody forms and seals
- field data sheets
- cooler(s)
- ice
- decontamination supplies/equipment
- canvas or plastic sheet
- spade or shovel
- spatula
- scoop
- plastic or stainless steel spoons
- trowel
- continuous flight (screw) auger
- bucket auger
- post hole auger
- sampling plan
- maps/plot plan

- extension rods
- T-handle
- sampling trier
- thin-wall tube sampler
- Vehimeyer soil sampler outfit
  - tubes
  - points
  - drive head
  - drop hammer
  - puller jack and grip
- backhoe

## 2.6 REAGENTS

Reagents are not used for the preservation of soil samples. Decontamination solutions are specified in ERT SOP #2006, Sampling Equipment Decontamination.

## 2.7 PROCEDURES

### 2.7.1 Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and which equipment and supplies are required.
2. Obtain necessary sampling and monitoring equipment.
3. Decontaminate or pre-clean equipment, and ensure that it is in working order.
4. Prepare schedules, and coordinate with staff, client, and regulatory agencies, if appropriate.
5. Perform a general site survey prior to site entry in accordance with the site-specific health and safety plan.
6. Use stakes, buoys, or flagging to identify and mark all sampling locations. Consider specific site

factors, including extent and nature of contaminant, when selecting sample location. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions. All staked locations will be utility-cleared by the property owner prior to soil sampling.

### 2.7.2 Sample Collection

#### *Surface Soil Samples*

Collect samples from near-surface soil with tools such as spades, shovels, and scoops. Surface material can be removed to the required depth with this equipment, then a stainless steel or plastic scoop can be used to collect the sample.

This method can be used in most soil types but is limited to sampling near surface areas. Accurate, representative samples can be collected with this procedure depending on the care and precision demonstrated by the sampling team member. The use of a flat, pointed mason trowel to cut a block of the desired soil can be helpful when undisturbed profiles are required. A stainless steel scoop, lab spoon, or plastic spoon will suffice in most other applications. Avoid the use of devices plated with chrome or other materials. Plating is particularly common with garden implements such as potting trowels.

Follow these procedures to collect surface soil samples.

1. Carefully remove the top layer of soil or debris to the desired sample depth with a pre-cleaned spade.
2. Using a pre-cleaned, stainless steel scoop, plastic spoon, or trowel, remove and discard a thin layer of soil from the area which came in contact with the spade.
3. If volatile organic analysis is to be performed, transfer a portion of the sample directly into an appropriate, labeled sample container(s) with a

stainless steel lab spoon, plastic lab spoon, or equivalent and secure the cap(s) tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into an appropriate, labeled container(s) and secure the cap(s) tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled container(s) and secure the cap(s) tightly.

#### *Sampling at Depth with Augers and Thin-Wall Tube Samplers*

This system consists of an auger, a series of extensions, a "T" handle, and a thin-wall tube sampler (Appendix A, Figure 1). The auger is used to bore a hole to a desired sampling depth, and is then withdrawn. The sample may be collected directly from the auger. If a core sample is to be collected, the auger tip is then replaced with a thin-wall tube sampler. The system is then lowered down the borehole, and driven into the soil at the completion depth. The system is withdrawn and the core collected from the thin-wall tube sampler.

Several types of augers are available. These include: bucket, continuous flight (screw), and posthole augers. Bucket augers are better for direct sample recovery since they provide a large volume of sample in a short time. When continuous flight augers are used, the sample can be collected directly from the flights, which are usually at 5-foot intervals. The continuous flight augers are satisfactory for use when a composite of the complete soil column is desired. Posthole augers have limited utility for sample collection as they are designed to cut through fibrous, rooted, swampy soil.

Follow these procedures for collecting soil samples with the auger and a thin-wall tube sampler.

1. Attach the auger bit to a drill rod extension, and attach the "T" handle to the drill rod.
2. Clear the area to be sampled of any surface debris (e.g., twigs, rocks, litter). It may be advisable to remove the first 3 to 6 inches of surface soil for an area approximately 6 inches in radius around the drilling location.
3. Begin augering, periodically removing and depositing accumulated soils onto a plastic sheet spread near the hole. This prevents accidental brushing of loose material back down the borehole when removing the auger or adding drill rods. It also facilitates refilling the hole, and avoids possible contamination of the surrounding area.
4. After reaching the desired depth, slowly and carefully remove the auger from boring. When sampling directly from the auger, collect sample after the auger is removed from boring and proceed to Step 10.
5. Remove auger tip from drill rods and replace with a pre-cleaned thin-wall tube sampler. Install proper cutting tip.
6. Carefully lower the tube sampler down the borehole. Gradually force the tube sampler into the soil. Care should be taken to avoid scraping the borehole sides. Avoid hammering the drill rods to facilitate coring as the vibrations may cause the boring walls to collapse.
7. Remove the tube sampler, and unscrew the drill rods.
8. Remove the cutting tip and the core from the device.

9. Discard the top of the core (approximately 1 inch), as this represents material collected before penetration of the layer of concern. Place the remaining core into the appropriate labeled sample container(s). Sample homogenization is not required.
10. If volatile organic analysis is to be performed, transfer a portion of the sample directly into an appropriate, labeled sample container(s) with a stainless steel lab spoon, plastic lab spoon, or equivalent and secure the cap(s) tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into an appropriate, labeled container(s) and secure the cap(s) tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into the appropriate, labeled container(s) and secure the cap(s) tightly.
11. If another sample is to be collected in the same hole, but at a greater depth, reattach the auger bit to the drill and assembly, and follow steps 3 through 11, making sure to decontaminate the auger and tube sampler between samples.
12. Abandon the hole according to applicable state regulations. Generally, shallow holes can simply be backfilled with the removed soil material.

#### *Sampling at Depth with a Trier*

The system consists of a trier, and a "T" handle. The auger is driven into the soil to be sampled and

used to extract a core sample from the appropriate depth.

Follow these procedures to collect soil samples with a sampling trier:

1. Insert the trier (Appendix A, Figure 2) into the material to be sampled at a (0° to 45° angle from horizontal. This orientation minimizes the spillage of sample.
2. Rotate the trier once or twice to cut a core of material.
3. Slowly withdraw the trier, making sure that the slot is facing upward.
4. If volatile organic analysis is to be performed, transfer a portion of the sample directly into an appropriate, labeled sample container(s) with a stainless steel lab spoon, plastic lab spoon, or equivalent and secure the cap(s) tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into an appropriate, labeled container(s) and secure the cap(s) tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into an appropriate, labeled container(s) and secure the cap(s) tightly.

#### *Sampling at Depth with a Split Spoon (Barrel) Sampler*

The procedure for split spoon sampling describes the collection and extraction of undisturbed soil cores of 18 or 24 inches in length. A series of consecutive cores may be extracted with a split spoon sampler to give a complete soil column profile, or an auger may



be used to drill down to the desired depth for sampling. The split spoon is then driven to its sampling depth through the bottom of the augured hole and the core extracted.

When split tube sampling is performed to gain geologic information, all work should be performed in accordance with ASTM D 1586-67 (reapproved 1974).

Follow these procedures for collecting soil samples with a split spoon.

1. Assemble the sampler by aligning both sides of the barrel and then screwing the bit onto the bottom and the heavier head piece onto the top.
2. Place the sampler in a perpendicular position on the sample material.
3. Using a sledge hammer or well ring, if available, drive the tube. Do not drive past the bottom of the head piece or compression of the sample will result.
4. Record in the site logbook or on field data sheets the length of the tube used to penetrate the material being sampled, and the number of blows required to obtain this depth.
5. Withdraw the sampler, and open by unscrewing the bit and head and splitting the barrel. If a split sample is desired, a cleaned, stainless steel knife should be used to divide the tube contents in half, longitudinally. This sampler is typically available in diameters of 2 and 3 1/2 inches. However, in order to obtain the required sample volume, use of a larger barrel may be required.
6. Without disturbing the core, transfer it to an appropriate labeled sample container(s) and seal tightly.

### *Test Pit/Trench Excavation*

These relatively large excavations are used to remove sections of soil, when detailed examination of soil characteristics (horizontal structure, color, etc.) are required. It is the least cost effective sampling method due to the relatively high cost of backhoe operation.

Follow these procedures for collecting soil samples from test pit/trench excavations.

1. Prior to any excavation with a backhoe, it is important to ensure that all sampling locations are clear of utility lines and poles (subsurface as well as above surface).
2. Using the backhoe, dig a trench to approximately 3 feet in width and approximately 1 foot below the cleared sampling location. Place removed or excavated soils on plastic sheets. Trenches greater than 5 feet deep must be sloped or protected by a shoring system, as required by OSHA regulations.
3. Use a shovel to remove a 1- to 2-inch layer of soil from the vertical face of the pit where sampling is to be done.
4. Take samples using a trowel, scoop, or coring device at the desired intervals. Be sure to scrape the vertical face at the point of sampling to remove any soil that may have fallen from above, and to expose fresh soil for sampling. In many instances, samples can be collected directly from the backhoe bucket.
5. If volatile organic analysis is to be performed, transfer a portion of the sample directly into an appropriate, labeled sample container(s) with a stainless steel lab spoon, plastic lab spoon, or equivalent and secure the cap(s) tightly. Place the remainder

of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into an appropriate, labeled container(s) and secure the cap(s) tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled container(s) and secure the cap(s) tightly.

6. Abandon the pit or excavation according to applicable state regulations. Generally, shallow excavations can simply be backfilled with the removed soil material.

## 2.8 CALCULATIONS

This section is not applicable to this SOP.

## 2.9 QUALITY ASSURANCE/ QUALITY CONTROL

There are no specific quality assurance activities which apply to the implementation of these procedures. However, the following QA procedures apply:

- All data must be documented on field data sheets or within site logbooks.
- All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation, and they must be documented.

## 2.10 DATA VALIDATION

This section is not applicable to this SOP.

## 2.11 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA, and specific health and safety procedures.

APPENDIX C  
BOREHOLE LOGS

100111

Site Name: Pyramid #1	Boring #: B-70	Page 1 of 1
Location: Trailer Park	W.A.:	Date Started: 12/6/54
Town/State: Harriman NY	Surface Elevation:	Date Completed: 12/6/54
Drilling Contractor: USEPA/Retc.	Sampler: 2" x 4' split spoon	
Drilling Equipment: Geo probe	Field Geologist: Joe Flors	
Drilling Method:	Driller: Brian McKeen	

[illegible]

**Environmental Protection Agency Environmental Re-  
sponse Engineering & Analytical Contract**

# Well Drilling and Installation Log

100112

Site Name: <i>Pradium #1</i>	Boring #: <i>B-130</i>	Page 1 of 1
Location: <i>Trailer Park</i>	W.A.:	Date Started: <i>12/6/94</i>
Town/State: <i>Itasca MN</i>	Surface Elevation:	Date Completed: <i>12/6/94</i>
Drilling Contractor: <i>USEPA/REAC</i>	Sampler: <i>2" x 4' split spoon</i>	
Drilling Equipment: <i>Geo probe</i>	Field Geologist: <i>Joe Filosa</i>	
Drilling Method:	Driller: <i>Brian Mc Kenna</i>	

[illegible]

**Environmental Protection Agency Environmental Response Team  
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## Well Drilling and Installation Log

100113

Site Name: <i>Pyridine #1</i>	Boring #: <i>B-160</i>	Page 1 of 1
Location: <i>Trailer park</i>	W.A.: <i>B-160 (i?)</i>	Date Started: <i>12/6/94</i>
Town/State: <i>Hammonton NJ</i>	Surface Elevation:	Date Completed: <i>12/6/94</i>
Drilling Contractor: <i>USEPA/REAC</i>	Sampler: <i>3"x4" split spoon</i>	
Drilling Equipment: <i>Clegg pipe</i>	Field Geologist: <i>Joe Fazio</i>	
Drilling Method:	Driller: <i>Don McKeever</i>	

[illegible]

100114

Site Name: <i>Yardion #1</i>	Boring #: <i>20-21 B-B</i>	Page 1 of
Location: <i>Trailer Park</i>	W.A.:	Date Started: <i>12/6/94</i>
Town/State: <i>Harrison NY</i>	Surface Elevation:	Date Completed: <i>12/6/94</i>
Drilling Contractor: <i>USEPA/REAC</i>	Sampler: <i>2" x 4' split spoon</i>	
Drilling Equipment:	Field Geologist: <i>Joe Flosa</i>	
Drilling Method:	Driller: <i>Brian McKENNA</i>	

[illegible]

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100115

## Well Drilling and Installation Log

Site Name: <i>Pyridium #1</i>	Boring #: <i>D-130 -</i>	Page ( of )
Location: <i>Traylor Park</i>	W.A.:	Date Started: <i>12/6/94</i>
Town/State: <i>Harrison NY</i>	Surface Elevation:	Date Completed: <i>12/6/94</i>
Drilling Contractor: <i>USEPA/REAC</i>	Sampler: <i>2" X 4" split spoon</i>	
Drilling Equipment: <i>Geo Probe</i>	Field Geologist: <i>Joe Filosa</i>	
Drilling Method:	Driller: <i>Brian McKee</i>	

Sample						OVA/ HNu	COMMENTS
Depth (Ft.)	#	Interval	Blows	Penetr/ Recov.	"N" Value		
0	1	0-4		4/3.5		42' total 15' 1' Brown 7.5 yr	
.5						4 1/3 organic silt, organic debris	
1.0						present. and 2.5' white product	
1.5						w/c black 7" lens of <del>black</del> <sup>dark brown</sup>	
2.0						dark brown 7.5 yr 3 1/2 organic	
2.5						silt at approx midpoint of	
3.0						the white product	
3.5							
4.0	2	4-8		4/2.9		1st 15" white product; and 10"	32' total inc
4.5						<sup>Black</sup> dark brown <sup>organic</sup> silt	
5.0						(w/Hand soil) organic Debris, 3rd	D-130-7'
5.5						8" very dark grey 7.5 yr 3/1	(Silt)
6.0						Clay + <sup>lt grey</sup> silt. low plasticity	
6.5						D-g.	D-130
7.0						& 10 white Fibers present in silt	8' (clay)
7.5							
8.0						Note: Litho change to a brown	
8.5						silt & clay at the 8' mark.	
						end of boring 8'	



## Response Engineering & Analytical Contract

## Well Drilling and Installation Log

100116

Site Name: Pyramid #1	Boring #: D-190	Page 1 of 1
Location: Trailer Park	W.A.:	Date Started: 12/6/94
Town/State: Harriman NY	Surface Elevation:	Date Completed: 12/6/94
Drilling Contractor: USEPA/RCRC	Sampler: 7" x 4' split spain	
Drilling Equipment: Geoprobe	Field Geologist: Joe Flisha	
Drilling Method:	Driller: Brian McKinnis	

[illegible]

**U.S. Environmental Protection Agency Environmental Response Team  
Response Engineering & Analytical Contract**

**Well Drilling and Installation Log**

**100117**

Site Name: <i>Hydron #1</i>	Boring #: <i>D-D</i>	Page 1 of 1
Location: <i>Trailer Park</i>	W.A.:	Date Started: <i>12/6/44</i>
Town/State: <i>Harriman NY</i>	Surface Elevation:	Date Completed: <i>12/6/44</i>
Drilling Contractor: <i>USEPA/REAC</i>	Sampler: <i>2"x4" Split Spc.</i>	
Drilling Equipment: <i>Geoprobe</i>	Field Geologist: <i>Joe Filosa</i>	
Drilling Method:	Driller: <i>Brian McKenna</i>	

Depth (Ft.)	Sample			Penetr/ Recov.	"N" Value	Sample Description	OVA/ HNu (ppm)	COMMENTS
	#	Interval	Blows					
0	1	0-4		4/3		TOP 6" BLANK ORGANIC SILT TURNING DEBRIS. 30" WHITE PRODUCT	0 ppm	
0.5								
1.0								
1.5								
2.0								
2.5								
3.0								
3.5								
4.0	2	4-8		4/1.7		20" (TOTAL) TOP 13.5" WHITE PRODUCT. 6.5" BLANK SET BROWN 10 YR 7/2 ORGANIC SILT - DRY (wetlands) ORGANIC MATTER (1/2 HRS PRESENT)	0 ppm	Sample D-D 5.5'
4.5								
5.0								
5.5								
6.0								
6.5								
7.0								
7.5								
8.0								
8.5								
						end of boring 8'		

**U.S. Environmental Protection Agency Environmental Response Team  
Response Engineering & Analytical Contract**

**100118**

**Well Drilling and Installation Log**

Site Name: <i>Pyridium #1</i>	Boring #: <i>E-90</i>	Page 1 of 1
Location: <i>Trailer Park</i>	W.A.:	Date Started: <i>12/6/94</i>
Town/State: <i>Tarrytown NY</i>	Surface Elevation:	Date Completed: <i>12/6/94</i>
Drilling Contractor: <i>US EPA/REAL</i>	Sampler: <i>2" x 4" spin spoon</i>	
Drilling Equipment: <i>Geo Probe</i>	Field Geologist: <i>Joe Flisak</i>	
Drilling Method:	Driller: <i>Bryan McConnaughy</i>	

Sample					Sample Description	OVA/ HNu (ppm)	COMMENTS
Depth (Ft.)	#	Interval	Blows	Penetr/ Recov.			
0	1	0-4		4/3.5	(4.5" total) white product with Brown organic silt		
.5							
1.0							
1.5							
2.0							
2.5							
3.0							
3.5							
4.0	2	4-8		4/1.2	(4.5" total) Black organic silt (wetland soil) grey & rock fragments 3" white pulver product to approx 7% wet. rock fragments at bottom of the core	30 ppm	Definite sulfur odor present sample E-90 7'
.5							
5.0							
5.5							
6.0							
6.5							
7.0							
7.5							
8.0					end of boring 8'		

100119

Site Name: <i>Pyridine nearby site #1</i>	Boring #: <i>E-210</i>	Page 1 of 7
Location: <i>Trailer Park</i>	W.A.:	Date Started: <i>12/6/94</i>
Town/State: <i>Harrison NJ</i>	Surface Elevation:	Date Completed: <i>12/6/94</i>
Drilling Contractor: <i>VSEPA/REAC</i>	Sampler: <i>2" x 4' split spc</i>	
Drilling Equipment: <i>Cheoprobe</i>	Field Geologist: <i>Joe Florka</i>	
Drilling Method:	Driller: <i>Brian McKeown</i>	

[illegible]

100120

Site Name: <i>Pyridium #1</i>	Boring #: <i>G-70</i>	Page 1 of
Location: <i>Trailer Park</i>	W.A.:	Date Started: <i>12/6/94</i>
Town/State: <i>Harriman NY</i>	Surface Elevation:	Date Completed: <i>12/6/94</i>
Drilling Contractor: <i>USEPA/RAE</i>	Sampler: <i>2" x 4' SPT</i>	
Drilling Equipment: <i>Crescent</i>	Field Geologist: <i>Joe Fiosa</i>	
Drilling Method:	Driller: <i>Blair McEanna</i>	

[illegible]

**U.S. Environmental Protection Agency Environmental Response Team  
Response Engineering & Analytical Contract**

**100121**

**Well Drilling and Installation Log**

Site Name: <i>pyridium #1</i>	Boring #: <i>G-170</i>	Page 1 of 1
Location: <i>Trailer Park</i>	W.A.:	Date Started: <i>12/6/94</i>
Town/State: <i>Harriman NY</i>	Surface Elevation: <i>N/A</i>	Date Completed: <i>2/6/94</i>
Drilling Contractor: <i>USEPA/REAC</i>	Sampler: <i>3" x 4' split spoon</i>	
Drilling Equipment: <i>Geoprobe</i>	Field Geologist: <i>Joe Flota</i>	
Drilling Method:	Driller: <i>Brian McKenna</i>	

SAMPLE						Sample Description	OVA/ HNu (ppm)	COMMENTS
Depth (Ft.)	#	Interval	Blows	Penetr/ Recov.	"N" Value			
0	1	0-4'		4/28		3" Brown organic silt organic debris (grass roots) present 30" white product.		
0.5								
1.0								
1.5								
2.0								
2.5								
3.0								
3.5								
4.0	2	4-8'		4/24		(38.5" Total rel) 1st 8" Brownish 16" 10 yr 1/4 silt and clay to fine sand poor compaction Rock frags present. <del>2nd 12" 12"</del>	5ppm HNu	sample G-170-4'
4.5								
5.0								
5.5								
6.0								
6.5						Grey 7.5 yr 5/1 med to fine sand and silt. grains sub rounded to rounded poorly sorted - moist little sub rounded gravel present		G-170-6.5' (5ppm HNu)
7.0								
7.5								
8.0	3	8-12'		4/28		34.5" Total! Top 5" Sand is above and interval but coarser in Sand. Grains poorly sorted. and 29.5" Lt Brown 10 yr 6/4 coarse Sand and silt to F Sand. general 1.5" gravel frags present. Grains are sub rounded to rounded poorly sorted. 2nd 12" saturated gravel frags sub angular to sub rounded.	7ppm HNu	now encountered! Sample G-170- 10'
8.5								
9.0								
9.5								
10.0								
10.5								
11.0								
11.5								
12.0								
12.5								
13.0								
13.5								
14.0								
14.5								
15.0								
						end of Boring 12'		

hole advanced 20' East of G170 on line between G170 and H170 - 0-6"

APPENDIX D

USEPA ERT/REAC SPECTRACE 2000 XRF SOP

**SPECTRACE 9000 FIELD PORTABLE X-RAY FLUORESCENCE  
OPERATING PROCEDURE**

**USEPA - SOP #1713**



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## 1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to serve as a guide to the start up, check out, operation, calibration, and routine use of the Spectrace 9000 instrument for field use in screening hazardous or potentially hazardous inorganics. It is not intended to replace or diminish the use of the Spectrace 9000 Operating Instructions. The Operating Instructions contain additional information for optimizing instrument performance and for utilizing its different applications.

The procedures contained herein are general operating procedures which may be changed as required, depending on site conditions, equipment limitations, limitations imposed by the Quality Assurance/Quality Control (QA/QC) procedure or other protocol limitations. In all instances, the procedures finally employed should be documented and included in any or all final reports.

### 1.1 Principles of Operation

X-Ray Fluorescence (XRF) Spectroscopy is a non-destructive qualitative and quantitative analytical technique used to determine the chemical composition of samples. In a source excited XRF analysis, primary X-rays emitted from a sealed radioisotope source are utilized to irradiate samples. During interaction of the source X-rays with samples, the source X-rays may either undergo scattering (dominating process) or absorption by sample atoms in a process known as the photoelectric effect. This most useful analytical phenomenon originates when incident radiation knocks out an electron from the innermost shell of an atom. The atom is excited and releases its surplus energy almost instantly by filling the created vacancy with an electron from one of the higher energy shells. This rearrangement of electrons is associated with the emission of X-rays characteristic (in terms of energy) of the given atom. This process is referred to as emission of fluorescent X-rays (fluorescent yield). The overall efficiency of the process described is referred to as excitation efficiency and is proportional to the product of the absorption coefficient and the fluorescent yield.

The Spectrace 9000 utilizes characteristic X-ray lines originating from the innermost shells of the atoms K, L and M. The characteristic X-ray lines of the K series are the most energetic lines for any element and, therefore, are the preferred analytical lines. The K lines are always accompanied by the L and M lines

of the same element. However, being of much lower energy than the K lines, they can usually be neglected for those elements for which the K lines are analytically useful. For heavy elements (such as cerium, atomic number (Z)=58, to uranium, Z=92), the L lines are the preferred lines for analysis. The  $L_{\alpha}$  and  $L_{\beta}$  lines have almost equal intensities, and the choice of one or the other depends on what interfering lines might be present. A source just energetic enough to excite the L lines will not excite the K lines of the same element. The M lines will appear together with the L lines.

The Spectrace 9000 Operating Instructions contain a table that identifies the X-rays (K or L) and elements measured for each excitation source.

An X-ray source can excite characteristic X-rays from an element only if the source energy is greater than the absorption edge energy for the particular line group (e.g., K absorption edge, L absorption edge, M absorption edge) of the element. The absorption edge energy is somewhat greater than the corresponding line energy. Actually, the K absorption edge energy is approximately the sum of the K, L, and M line energies, and the L absorption edge energy is approximately the sum of the L and M line energies of the particular element.

Energies of the characteristic fluorescent X-rays are converted (within the detector) into a train of electric pulses, the amplitudes of which are linearly proportional to the energy. An electronic multichannel analyzer (electronic unit) measures the pulse amplitudes, which is the basis of a qualitative X-ray analysis. The number of counts at a given energy is representative of element concentration in a sample and is the basis for quantitative analysis.

#### 1.1.1 Scattered X-rays

The source radiation is scattered from the sample by the physical process: coherent or elastic scattering (no energy loss), and Compton or inelastic scattering (small energy loss). Thus, the backscatter (background signal) actually consists of two components with X-ray lines close together. The higher energy line is equal to the source energy. Since the whole sample takes part in scattering, the scattered X-rays usually yield the most intense lines in the spectrum.

Since the scattered X-rays have the highest energies in the spectrum, they contribute most of the total measured intensity signal.

## 1.2 Sample Types

Solid and liquid samples can be analyzed for elements aluminum through uranium with proper X-ray source selection and instrument calibration. Typical environmental applications are:

- Heavy metals in soil (in situ or samples collected from the surface or from bore hole drillings, etc.), sludges, and liquids (e.g., lead in gasoline)
- Light elements in liquids (e.g., phosphorous, sulphur, and chlorine in organic solutions)
- Heavy metals in industrial waste stream effluents
- PCB in transformer oil by Cl analysis
- Heavy metal air particulates collected on membrane filters, either from personnel samplers or from high volume samplers
- Lead in paint.

## 2.0 METHOD SUMMARY

The Spectrace 9000 Portable XRF Analyzer employs the radioactive isotope sources iron-55, cadmium-109, and americium-241 for the production of primary X-rays. Each source emits a specific energy range of primary X-rays that cause a corresponding range of elements in a sample to produce fluorescent X-rays. When more than one source can excite the element of interest, the appropriate source(s) is selected according to its excitation efficiency for the element of interest. See page 1-2 of the Spectrace 9000 Operating Instructions for a chart of source types versus element range.

The sample is positioned in front of the source-detector window, and sample measurement is initiated which exposes the sample to primary radiation from the source. Fluorescent and backscattered X-rays from the sample enter through the beryllium detector window and are counted in the high resolution mercuric iodide (HgI<sub>2</sub>) detector.

Elemental concentrations are computed using a Fundamental Parameter (FP) algorithm of the form:

$$\text{Concentration} = R \times S \times (1 + \text{SUM}\{A_a \times C_a\})$$

"R" is the measured analyte X-ray intensity to the pure element; "S" is a calculated sensitivity coefficient. The quantity SUM{} is a summation of the "n"-element absorption-enhancement terms containing alpha-coefficients and iteratively computed element concentrations. The Spectrace 9000 utilizes FP XRF calibrations derived from theoretical considerations (as opposed to empirical data). The menu-driven software in the Spectrace 9000 supports multiple XRF calibrations called "Applications." Each Application is a complete analysis configuration including elements to be measured, interfering elements in the sample, and a set of FP calibration coefficients.

The measurement time of each source is user-selectable. The shorter source measurement times (15 - 30s) are generally used for initial screening and hot spot delineation, while longer measurement times (30 - 500s) are typically used for higher precision and accuracy requirements.

## 3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

This SOP specifically describes equipment operating procedures for the Spectrace 9000; hence, this section is not applicable to this SOP.

## 4.0 INTERFERENCE AND POTENTIAL PROBLEMS

The total method error for XRF analysis is defined as the square root of the sum of both instrument precision and user or application related error. Generally, the instrument

precision is the least significant source of error in XRF analysis. User or application related error is generally more significant and will vary with each site and method used. The components of the user or application related error are as follows:

#### 4.1 Sample Placement

This is a potential source of error because the X-ray signal decreases as the distance from the radioactive source is increased. However, this error is minimized by maintaining the same distance for each sample.

#### 4.2 Sample Representivity

This can be a major source of error if the sample does not represent the site. Representivity is affected by the soil macro- and micro-heterogeneity. For example, a site contaminated with pieces of slag dumped by a smelting operation will be more heterogenous than a site contaminated by liquid plating waste. This error can be minimized by either mixing a large volume of sample prior to analyzing an aliquot, or by analyzing several locations (in situ) at each sampling point and averaging the results.

#### 4.3 Reference Analysis

Soil chemical and physical matrix effects may be corrected by using Inductively-Coupled Plasma (ICP) or Atomic Absorption (AA) spectroscopy analyzed site-specific soil samples as calibration samples. A major source of error can result if the samples analyzed are not representative of the site and/or if the analytical error is large. Additionally, when comparing XRF results with reference analysis results, the efficiency of the sample digestion reference analysis should be considered. Some digestion methods may breakdown different sample matrices more efficiently than others.

#### 4.4 Chemical Matrix Effects (Due to the Chemical Composition of the Sample)

Chemical matrix effects result from differences in concentrations of interfering elements. These effects appear as either spectral interferences (peak overlaps) or X-ray absorption/enhancement phenomena. Both effects are common in soils contaminated with heavy metals, eg., iron tends to absorb copper X-rays, reducing the intensity of Cu measured by the detector. This effect can be corrected mathematically

through the use of FP coefficients.

#### 4.5 Physical Matrix Effects (Due to Sample Morphology)

Physical matrix effects are the result of variations in the physical character of the sample. They include such parameters as particle size, uniformity, homogeneity, and surface condition. For example, consider a sample in which the analyte exists in the form of very fine particles within a matrix composed of much coarser material. If two separate aliquots of the sample are prepared in such a way that the matrix particles in one are much larger than in the other, then the relative volume of analyte occupied by the analyte-containing particles will be different in each. When measured, a larger amount of the analyte will be exposed to the source X-rays in the sample containing finer matrix particles; this results in a higher intensity reading for that sample and, consequently, an apparently higher measured concentration for that element.

#### 4.6 Application Error

Generally, the error in the application calibration is insignificant (relative to the other sources of error) IF the instrument's application operating instructions are followed correctly. However, if the sample matrix varies significantly from the design of the application (e.g., using the soil's application to analyze 50% iron mine tailing sample) the application error may become significant.

#### 4.7 Moisture Content

Sample moisture content will affect the analytical accuracy of soils or sludges. The overall error may be secondary when the moisture range is small (5-20%), or it may be a major source of error when measuring the surface of soils that are saturated with water.

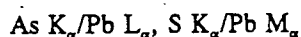
#### 4.8 Cases of severe X-ray Spectrum Overlaps

When present in the sample, certain X-ray lines from different elements can be very close in energy, and therefore, interfere by producing a severely overlapped spectrum.

The typical spectral overlaps are caused by the  $K_{\alpha}$  line of element Z-1 (or as with heavier elements, Z-2

or Z-3) overlapping with the  $K_{\alpha}$  line of the Z element. This is the so-called  $K_{\alpha}/K_{\beta}$  interference. Since the  $K_{\alpha}/K_{\beta}$  intensity ratio for the given element usually varies from 5:1 to 7:1, the interfering element, Z-1, must be present in large concentrations in order to disturb the measurement of analyte Z. The presence of large concentrations of vanadium (V) could disturb the measurement of chromium (Cr). The V  $K_{\alpha}$  and  $K_{\beta}$  energy is 5.41 keV. The resolution of the detector is approximately 270 eV. Therefore, large amounts of V in a sample will result in spectral overlap of the V  $K_{\beta}$  with the Cr  $K_{\alpha}$  peak. The Spectrace 9000 uses overlap factors to correct for  $K_{\alpha}/K_{\beta}$  spectral overlaps for the elements of interest for a given application.

Other interferences are K/L, K/M, and L/M. While these are less common, the following are examples of a severe overlap:



In the arsenic (As)/lead case, Pb can be measured from the Pb  $L_{\beta}$  line, and arsenic from either the As  $K_{\alpha}$  or the  $K_{\beta}$  line; this way the unwanted interference can be corrected. However, due to the limits of mathematical corrections, measurement sensitivity is reduced. Generally, As concentrations in samples with Pb:As ratios of 10:1 or more can not be efficiently calculated. This may result in zero As being reported regardless of what the actual As concentration is.

## 5.0 EQUIPMENT/APPARATUS

### 5.1 Description of the Spectrace 9000 System

The analyzer utilizes the method of Energy Dispersive XRF (EDXRF) spectrometry to determine the elemental composition of soils, sludges, aqueous solutions, oils, and other waste materials.

The Spectrace 9000 analyzer includes three, compact, sealed, radiation sources contained in a measuring probe. The three excitation sources provided are Fe-55, Cd-109 and Am-241. The analyzer software automatically selects which sources to use and the measurement time for each source based on stored information for each application. The probe is equipped with a high resolution  $\text{HgI}_2$  detector. This probe is connected by cable to an environmentally sealed electronic module.

The electronic unit provides internal non-volatile memory for storage of 120 spectra and 300 multi-element analytical reports. An RS-232 serial port is provided for downloading data and spectra to a peripheral device. The multi-element analytical reports and the 2000-channel spectra can be displayed on the instrument's LCD panel. The replaceable and rechargeable internal battery provides for field-portable operation.

The Spectrace 9000 is supplied with three factory-installed FP-based applications (calibrations). A "Soil Samples" application is provided for analysis of soils where the balance of the sample, or that portion not directly measured by the instrument, is silica ( $\text{SiO}_2$ ). A "Thin Film" application is provided for analysis of thin films such as air monitoring filters or wipes. A "PbK in Paint" application is provided for analysis of Pb in paint and is reasonably independent of the type of substrate. Additionally, Spectrace will develop calibrations to meet new user applications (e.g., adding elements to the present "Soil Samples" application).

The Spectrace 9000 can be powered from a 115-volt (or 220-volt) wall outlet or from its four-hour capacity battery. It can be operated in temperatures ranging from 32 to 120°F.

The probe and electronic unit may be exposed to a light rain. However, additional protection is provided when the system (electronic unit and probe) is contained in the optional water repellant carrying case.

### 5.2 Equipment and Apparatus List

#### 5.2.1 Spectrace 9000 analyzer System

The complete Spectrace 9000 Analyzer System includes:

- Analyzer unit for data acquisition, processing and display
- Hand-held probe including:
  1. High-resolution  $\text{HgI}_2$  detector

2. Three excitation sources  
(<sup>55</sup>Fe, <sup>109</sup>Cd, <sup>241</sup>Am)
3. Safety cover

- Spare probe window assembly

• Probe laboratory stand with the following:

1. Base for table top use
2. Safety shield over sample
3. Positioning fixtures for standard 30mm and 40mm X-ray sample cups
4. Interconnecting cable
5. RS-232C Interface cable
6. Two blank check samples
7. Pure element check samples
8. Battery charger
9. Battery pack
10. System carrying/shipping case

Spectrace 9000 Operating Instructions, application software and utilities software. The application software is specific to each unit and cannot be interchanged between different units. The software is identified by the serial number of the unit.

### 5.2.2 Optional items

- 31-mm diameter sample cups
- X R F polypropylene film, 0.2 mil thick
- Field carrying case
- Peripheral devices such as a printer or IBM compatible

Spare battery pack, charger and charger adaptor (required to charge spare battery outside of data unit)

See the Spectrace 9000 Accessories Price List for additional options.

For mobile lab or laboratory X-ray sample preparation accessories, such as drying ovens, grinders, sieves, etc., consult general laboratory equipment suppliers.

### 5.2.3 Limits and Precautions

The probes should be handled in accordance with the following radiological control practices:

1. The probe should always be in contact with the surface of the material being analyzed and the analyzed material should completely cover the probe opening (aperture) when the source is exposed. Do not remove a sample or move the probe while the indicator shows **SOURCE ON**.

**SOURCE ON** indicators are:

- a. the message on the screen "SOURCE ON"
  - b. the flashing light at the base of the probe.
2. When the sources are exposed, under no circumstances should the probe be pointed at the operator or surrounding personnel.
  3. Do not place any part of the operator's or co-worker's body in line of exposure when the sources are exposed or partially covered.



4. The probe must be covered with the safety cover or laboratory safety shield when not in use.
5. Spectrace Instruments must be notified immediately of any condition or concern relative to the probe's structural integrity, source shielding, source switching condition, or operability.
6. The appropriate state agency or the Nuclear Regulatory Commission (NRC) office must be notified (see factory supplied data on radiological safety) immediately of any damage to the radioactive source, or any loss or theft of the device.
7. Labels or instructions on the probe(s) must not be altered or removed.
8. The user must not attempt to open the probe.
9. The source(s) in the probe must be leak tested every six months as described in the Spectrace 9000 Operating Instructions. The leak test Certificates must be kept on file, and a copy must accompany the instrument at all times.
10. The probe laboratory safety shield assembly must be used when the probe is inverted for measuring samples contained in cups.
11. During operation, the probe must be kept at least 10 feet from computer monitors and any other source of radio frequency (RF). Some monitors have very poor RF shielding and will affect measurement results.
12. The Spectrace 9000 should not be dropped or exposed to conditions of excessive shock or vibration.

Additional precautions include:

1. The probe cable must never be pulled while unplugging the probe. The probe plug should be grasped at the ribbed metal connector and squeezed and pulled gently while unplugging the connector. The connector must never be forced when plugging in the connector.
2. The handle of the electronic unit must not be rotated unless the release buttons on each side of the handle are depressed.
3. The Spectrace 9000 should not be stored at an ambient temperature below -4°F or above 110°F.
4. The battery charging unit should only be used indoors in dry conditions.
5. Battery packs should be changed only in dry conditions.

### 5.3 Peripheral Devices

The Spectrace 9000 may be used with a wide range of peripheral devices for electronic data capture or printed readout as long as they are compatible with the RS-232 serial I/O protocol. Such devices include terminals, printers, electronic data loggers, PCs, etc.

#### 5.3.1 Communication Cable Connection

Plug the 25-pin connector of the RS-232 Serial I/O cable into the Spectrace 9000 25-pin D connector (the connector just below the display screen on the electronic unit) and the 9-pin connector of the cable into the serial port of the receiving device.

#### 5.3.2 Communication Port Setup

To communicate with an external device, the Spectrace 9000 MUST be set at the same baud rate, word length, and parity as the receiving device. The Spectrace 9000 allows you to select various configurations for these parameters in the communication

(Comm.) port setup portion of the More submenu (accessed from the main menu). The default COM setup for application and utilities software is 9600, N, 8, 1.

### 5.3.3 User Software

Refer to your PC software manual for details on additional settings that may be required for proper interfacing between the Spectrace 9000 and your particular software.

## 5.4 Instrument Maintenance

### 5.4.1 Probe Window

Should the probe window become damaged or punctured, it should be replaced as soon as possible to prevent dust and moisture from entering the probe. Replacement window assemblies can be ordered from Spectrace Instruments. Note the location of the window aperture; it is closer to one end of the window plate. Simply unscrew the old window plate, press any corner of it and remove. Stretch the O-ring for 10 seconds, and lay it back in the groove. The O-ring must lie flat in the groove in order for the new window plate to be installed. Install the new window assembly in the same orientation as the old. If the surface of the window plate is not flush with the face of the probe, the O-ring has probably come out of the groove. Remove the assembly, and try the same procedure again.

### 5.4.2 Further Information and Troubleshooting

Refer to the Spectrace 9000 Operating Instructions for additional detailed operation and/or maintenance and troubleshooting instructions. If no solution is found in the manual, contact Spectrace Instruments for assistance.

An instrument log should be maintained to document specific corrective actions taken to alleviate any instrument problems, or for recording any service that has been performed.

## 6.0 REAGENTS

Generally, calibration standards are not necessary for site screening and extent of contamination analyses. Optionally, an application (only the Soil Sample application will be discussed here) can be optimized or verified to be 1:1 proportional to another analytical (reference) method. This can be done by analyzing a set of Site-Specific Calibration Standards (SSCS) and performing a regression analysis on the reference (dependent) and the Spectrace 9000 results (independent) for each element of concern. In an application, any element's calibration can be adjusted by entering the desired slope and offset (intercept) in the Adjust Calibration menu. If any element's calibration has been adjusted in an application, "adj" will appear on the results screen. An adjusted element calibration can be changed back to the initial slope and offset values of 1 and 0, respectively, in the application.

### 6.1 Site-Specific Calibration Standards (SSCS)

SSCS must be representative of the matrix to be analyzed by XRF. The concentration of the target elements in the SSCS should be determined by independent AA or ICP analyses that meet quality levels for referee data.

#### 6.1.1 SSCS Sampling

See section 4.2 on sample representivity. The SSCS samples must be representative of the matrix to be analyzed by XRF. It does not make sense to collect SSCS samples in the site containment area if you are interested in investigating off-site contamination migration. The matrices may be different and could affect the accuracy of the XRF results. If there are two different matrices on site, collect two sets of SSCS samples.

A full range of target element concentrations is needed to provide a representative calibration curve. Mixing high and low concentration soils to provide a full range of target element concentrations is not recommended due to heterogeneity problems. Unlike liquid samples, solid samples cannot be diluted and re-analyzed.

Additionally, collect several SSCS samples in the concentration range of interest. If the

action level of the site is 500 mg/kg, providing several SSCS samples will tend to improve the XRF analytical accuracy in this concentration range.

Generally, a minimum of seven appropriate SSCS samples should be taken. A minimum sample size of 4 oz. is recommended. A larger size sample should be taken to compensate for sites with greater content of non-representative materials such as rocks and/or organic debris. Standard glass sampling jars should be used.

### 6.1.2 SSCS Preparation

The SSCS samples should be either air dried overnight, or oven dried at less than 105°C. Aluminum drying pans of large plastic weighing boats for air drying may be used. After drying, remove all large organic debris and non-representative material (twigs, leaves, roots, insects, asphalt, rocks, etc.).

The sample should be sieved through a 10-mesh stainless steel sieve. Clumps of soil and sludge should be broken up against the sieve using a stainless steel spoon. Pebbles and organic matter remaining in the sieve should be discarded. The under-sieve fraction of the material constitutes the sample.

Although the maximum final particle size of 10-mesh is normally recommended, a smaller particle size may be desired. The sample should be mixed by dividing the sieved soil into quarters and physically mixing opposite quarters with a clean stainless steel spoon. Re-combine and repeat the quartering and mixing procedure three times. Place the sieved sample in a clean sample jar and label it with both the site name and sample identification information.

The stainless Steel sieves should be decontaminated using soap and water. They should be dried between samples.

One or more plastic XRF sample cups should be filled with the sieved soil for each SSCS sample. A piece of 0.2-mil polypropylene film should be cut and stretched over the top of the X-ray sample cup until the film is wrinkle-free, then sealed using the plastic securing ring. The cup should be labeled using both the site name and specimen identification information.

Either the XRF sample cup or the balance of the prepared sample, is submitted to the approved laboratory for analysis of the requested element(s) by AA or ICP.

## 7.0 PROCEDURE

### 7.1 Prerequisites

If the Spectrace 9000 will be used in a location where AC power outlets are conveniently accessible, connect the battery charger to the electronic unit and plug the charger cord into the outlet. The probe cable must be connected before the power is switched on. Plugging and unplugging this cable with the power on can damage the detector.

To connect the battery, set the electronics unit on its face and use a flat blade screwdriver to loosen the two one-quarter turn fasteners on the back. Remove the battery pack. Inside, find the cord with the red cap covering the three-pronged plug. Remove the cap and plug it into the battery pack. Put the battery pack into the unit and tighten the fasteners.

Apply power to the Spectrace 9000 by pressing the <ON> button. The electronic unit may not come on with the battery charger hooked up if the battery has been totally drained. The drained battery may require a 10 minute charge prior to start up. In a few seconds, the display shows the version of software. If necessary, adjust the contrast knob located on the underside of the front display. This knob can be turned so far that the display appears blank.

The initial screen displays for about 10 seconds and then a prompt will ask if the time and date are set correctly. The date MUST be set correctly, otherwise serious errors in the source-decay compensation can result. Additionally, the results

tables include the time and date of analysis. The main menu appears after the time and date screen.

If a "battery low" message appears, recharge the battery before proceeding, or operate the unit using line voltage.

Allow the Spectrace 9000 to warm up for approximately 30 minutes after it has been turned on, before performing analysis.

### 7.1.1 Gain Control

Automatic gain compensation is a feature of both Soil and Thin Samples applications that allow operation of the instrument over a wide range of ambient temperatures and from one day to another without standardization. To maintain this gain control compensation, it is necessary to operate it occasionally with a minimum acquisition time of 50 seconds on the Cd-109 source. If the automatic gain control fails or is out of range, an error message will appear on the screen. If the error message continues to appear after repeat analyses, then the Cd-109 measurement time should be checked and/or an energy calibration should be performed. If the problem continues, contact Spectrace Instruments for help.

### 7.1.2 Setting Data and Spectrum Store/Send Mode

The *Set store/send modes* option is located in the More screen of the main menu. Data and/or Spectrum storage must be enabled for automatic on-board storing to occur. Sufficient memory is available to store up to 300 sets of analytical results and up to 120 spectra (spectra for 40 samples since each sample has three spectra). When the available spectra or results memory is full, the spectra or results storage mode is disabled. The filled spectra or results memory must be cleared (deleted) and the respective store mode enabled before results and/or spectra will be stored again.

## 7.2 General Keys and Menu Software

This section outlines the general keys and basic menu software. Flow charts which describe the menu structure in detail are located in pages 4-13 through 4-17 of the Spectrace 9000 Operating Instructions.

### 7.2.1 The Keyboard

The row of numeric keys under the LCD screen performs functions defined by labels that the software writes (a menu) to the bottom line of the display. As you move through the various menus, the keys are redefined to provide an efficient user interface.

The keypad to the right of the screen is used for numeric entry. The <CONT/PAUSE> key (referred to as the <CONT>) is used:

- to enter information as an <ENTER> key
- to begin an analysis
- to pause an analysis in progress

The <-> (left arrow) key is used to edit entries before pressing <CONT>.

### 7.2.2 The Measure (Ready) Screen

This main menu selection displays the application name, revision date and count times for each of the three sources, and accesses other options (see flow diagrams in the Spectrace 9000 Operating Instructions).

### 7.2.3 The Choose an Application Screen

This main menu selection lists the applications currently loaded in the unit. Applications are selected and source measurement times may be modified in this screen (see flow diagrams in the Spectrace 9000 Operating Instructions).

### 7.2.4 The Review Stored Results Screen

This main menu selection lists the stored results. *Up* and *Down* scroll are used on many screens. When *Up* and *Down* are displayed, pressing the <0> (zero) key will toggle to *PgUP* and *PgDN* for rapid movement through long lists. Stored results may be reviewed, deleted or sent out the COM port (see flow diagrams in the Spectrace 9000 Operating Instructions).

### 7.2.5 The Review Stored Spectra Screen

This menu selection lists the stored spectra which may be deleted or transmitted to the COM port (see flow diagrams in the Spectrace 9000 Operating Instructions). You cannot review spectra under this screen. Spectra may be reviewed in the *Examine Spectrum* portion of the Results screen under the *More Options* menu selection.

### 7.2.6 The More (Other Functions) Screen

This main menu selection lists the following functions:

- *Set clock/calendar*
- *Comm. port setup*
- *Set store/send modes*
- *Application maintenance*
- *Examine spectrum*

### 7.2.7 The Results Screen

At the end of the analysis, the Results screen is displayed. If the automatic *Store Results* mode is enabled, you will be prompted for sample identification (*ID*) before the results screen is displayed. *UP* or *DOWN* scrolls the screen to see more results. When *UP* and *DOWN* are displayed, pressing the <0> key will toggle to *PgUP* and *PgDN* for rapid movement through long lists. *Send* transmits the results report to the COM port. *Store* prompts you to enter an *ID* and then stores the results in the memory. *Measr* will immediately begin another analysis

cycle. *Opts* will bring up the first of two screens (the second screen is located under *More Opts* of the first screen) of special options under the Results screen (see flow diagrams in the Spectrace 9000 Operating Instructions). The most frequently used functions are the *Examine Spectrum* and *Enable/Disable Display Thresholds* located on the second screen of the options.

## 7.3 Pre-operational Checks

### 7.3.1 Energy Calibration Checks

The Energy calibration check is performed daily in the field to verify proper energy calibration. To do this, place the safety cover on the probe. Select the Soil Samples application and measure the safety shield using a minimum acquisition time of 60 seconds for each source. Save the results and spectra for documentation. Select *Examine Spectrum* under the More Options selection of the Results screen. Examine the spectrum of each source. Locate and record the centroid KeV (using the x12 horizontal magnification) for each of the following peaks:

Source Peak		Theoretical (KeV)	Specification (KeV)
Cd-109	Pb L-alpha	10.54	+/- 0.040
	Pb L-beta	12.61	+/- 0.040
	Pb L-gamma	14.76	+/- 0.040
	Emission peak	22.10	+/- 0.040
Fe-55	S K-alpha	2.31	+/- 0.010
	Emission peak	5.89	+/- 0.010
Am-241	Pb L-alpha	10.54	+/- 0.050
	Pb L-beta	12.61	+/- 0.050
	Pb L-gamma	59.5	+/- 0.20

Perform an *Energy calibration* (see Spectrace 9000 Operating Instructions) and then do another if any of the peaks fail to meet specification. The energy calibration check should be performed once at the beginning of the day, after an energy calibration, after loading an application, and whenever the instrument exhibits a persistent drift.

### 7.3.2 Resolution Check

The resolution check examines the detector's ability to resolve X-ray energies. This should be performed once at the beginning of the day. Select the Soil Samples application, and measure a sample of iron using a minimum acquisition time of 60 seconds for the Cd-109 source. Save the results and spectra for documentation. Select *Examine spectrum* under the More Options screen of the Results screen. Examine the Cd-109 spectrum. Locate and record the maximum peak counts (must be > 1000 counts) of the iron K-alpha peak (6.4 KeV) using the x12 horizontal magnification. Divide the maximum peak counts by two. Examine the right side of the peak and record the counts an KeV of the channel just above one-half the maximum peak count value. Examine the left side of the peak and record the counts and KeV of the channel just below one-half the maximum peak count value. Subtract the left-side KeV from the right-side KeV. The difference should be less than 0.300 KeV. If the unit fails to meet this specification, call Spectrace Instruments for assistance.

### 7.3.3 Blank (Zero) Sample Check

The blank (Zero) sample check is performed to monitor the instrument's zero drift. This should be done once at the beginning of the day, after an energy calibration, after loading an application, and whenever the instrument exhibits a persistent drift on a blank or low level sample.

Mount the probe in the laboratory stand and select the Soil Samples application. Disable the display thresholds. This will permit results less than one standard deviation (STD) to be displayed (even negatives). Measure the Teflon™ blank provided with the unit using a minimum acquisition time of 60 seconds for each source. Review the results table. Most (95%) of the elemental results should be  $0 \pm (2 \times \text{STD})$  (their respective standard deviation), and all of them (99%) should be  $0 \pm (3 \times \text{STD})$  (their respective standard deviation). Repeat the

measurement if the unit fails to meet these specifications. If several elements continue to be significantly outside of these specifications, check the probe window and the blank sample for contamination or perform the *Acquire background data* operation located in the Measure (Ready) screen option. Perform the blank (Zero) sample check again. Save the results and spectra for documentation. Enable the display thresholds prior to sample analysis after the blank check procedure is completed.

### 7.3.4 Target Element Response Check

The purpose of the target element response check is to ensure that the instrument and the selected application are working properly prior to performing sample analysis. This check should be performed at the beginning of the day. Use low, mid, and high samples, or standards with known concentrations for some or all of the target elements to be checked. Select a low sample near the quantitation limit of the target elements. Select a mid sample near the site action level and a high sample near the maximum concentration of the target elements expected on site.

These samples should be measured using the same source acquisition times that will be used for sample analysis. Save the sample check results and spectra for documentation.

## 7.4 Selecting Source Measuring Time

The source measuring time may be modified under the Measure screen. Zero (seconds) should never be selected for any application. Generally, for source measurements up to 1000 seconds, the element detection limit will be reduced by 50% for every four-fold (x4) increase in source measuring time. The elements are grouped together according to the radioisotope used for their excitation with typical minimum detection limits shown in Sections 7.4.2 and 7.4.3.

Automatic gain compensation is a feature of both the Soil and Thin Samples applications which allows operation of the instrument over a wide range of ambient temperatures and from one day to another

without standardization. To maintain this gain control compensation, it is necessary, occasionally, to operate with a minimum acquisition time of 50 seconds on the Cd-109 source.

The *Real/live* option toggles between real time (true clock time) and live time (total time the instrument is counting). The latter adds time to the analysis to make up for the time the system is busy processing pulses.

#### 7.4.1 Minimum Source Measuring Times

A minimum measuring time (real or live) of 20 seconds for the Fe-55 source, 30 seconds for the Cd-109 source, and 10 seconds for the Am-241 source is recommended when using the Soil Samples application. Measuring times for a source that excites a target element can be increased if lower detection limits are required.

When using the Thin Samples application, the measuring time for any source may be reduced to 10 seconds if the source does not excite a target element since this application does not correct for interelement effects. If a source excites a target element, a minimum measuring time (real or live) of 60 seconds for the Fe-55 source, 60 seconds for the Cd-109 source, and 120 seconds for the Am-241 source is recommended.

A minimum of 60 seconds is recommended for the Cd-109 source when using the PbK in Paint application.

#### 7.4.2 Typical Minimum Detection Limits (MDLs) for the Soil Samples Application

For source measuring times of 60 seconds, the typical element milligram per kilogram (mg/kg) MDLs for the Soil Samples application are:

Source	Element	ug/cm <sup>2</sup>
Fe-55	Potassium (K)	325
	Calcium (Ca)	150
	Titanium (Ti)	110
Cd-109	Chromium (CrLo)	180
	Chromium (CrHi)	525
	Manganese (Mn)	410
	Iron (Fe)	225
	Cobalt (Co)	205
	Nickel (Ni)	125
	Copper (Cu)	90
	Zinc (Zn)	70
	Mercury (Hg)	60
	Arsenic (As)	50
	Selenium (Se)	35
	Lead (Pb)	30
	Rubidium (Rb)	10
	Strontium (Sr)	10
Am-241	Zirconium (Zr)	10
	Molybdenum (Mo)	10
	Cadmium (Cd)	180
	Tin (Sn)	100
	Antimony (Sb)	65
	Barium (Ba)	20

Generally, for source measurements up to 1000 seconds, the element detection limit will be reduced by 50% for every four-fold (x4) increase in source measuring time. Additionally, more elements may be added to the Soil Samples application. Contact Spectrace Instruments for information about modifications to applications.

#### 7.4.3 Typical Minimum Detection Limits (MDLs) for the Thin Samples Application

For source measuring times of 200 seconds for the Fe-55 and Cd-109 sources, and 800 seconds for the Am-241 source, the typical element microgram per square centimeter (ug/cm<sup>2</sup>) MDLs for the Thin Samples application are:

Source	Element	ug/cm <sup>2</sup>
Fe-55	Potassium (K)	325
	Calcium (Ca)	150
	Titanium (Ti)	110

Source	Element	ug/cm <sup>2</sup>
Cd-109	Chromium (CrLo)	180
	Chromium (CrHi)	525
	Manganese (Mn)	410
	Iron (Fe)	225
	Cobalt (Co)	205
	Nickel (Ni)	125
	Copper (Cu)	90
	Zinc (Zn)	70
	Mercury (Hg)	60
	Arsenic (As)	50
	Selenium (Se)	35
	Lead (Pb)	30
	Rubidium (Rb)	10
	Strontium (Sr)	10
	Zirconium (Zr)	10
Am-241	Molybdenum (Mo)	10
	Cadmium (Cd)	180
	Tin (Sn)	100
	Antimony (Sb)	65
	Barium (Ba)	20

Generally, for source measurements up to 1000 seconds, the element detection limit will be reduced by 50% for every four-fold (x4) increase in source measuring time. Use of thick filters, filters with high background or contamination will result in higher MDLs and require a background subtraction. Additionally, more elements may be added to the Thin Samples application. Contact Spectrace Instruments for information about modifications to applications.

## 7.5 Sample Handling and Presentation

When making XRF measurements, be sure to maintain constant measurement geometry in order to minimize variations in analysis results. Document any anomalies in measurement geometry, sample surface morphology, moisture content, sample grain size, and matrix (see Section 4.0).

### 7.5.1 Soil Samples

Soil samples may be analyzed either in situ or in prepared X-ray sample cups. The Soil Samples application assumes the sample to be infinitely thick. For in situ measurements this is almost always the case,

but, for sample cup measurements it is advisable to fill the cup nearly full and tap it on the bench to compact the soil. This ensures that the sample is as uniformly thick as possible from sample to sample. The Spectrace 9000 laboratory stand and safety shield should be used when analyzing sample cups.

An area for in situ analysis should be prepared by removing large rocks and debris. The soil surface should be rendered flat and compact prior to analysis. The Spectrace 9000 probe should be held firmly on the ground to maximize instrument contact with the ground. The probe should not be moved during analysis. Analysis of water saturated soils should be avoided. A layer of 0.2-mil polypropylene XRF film may be mounted on the surface probe to minimize contamination. Use of varying thicknesses of plastic (bags) have been shown to interfere in the light element measurement and may affect the FP calibration of the other element concentrations. Additionally, plastic may contain significant levels of target element contamination.

Coarse-grained soils conditions or nuggets of contaminated material may not permit a truly representative sample and may adversely affect the analysis results (typically by under reporting the target element). Such samples should be prepared before analysis. Preparation consistency is important to minimize variation in analytical results.

This application is specifically designed for soil with the assumption that the balance of the material is silica. If samples with a much lighter balance are analyzed, the results will typically be elevated by a factor of two to four. Contact Spectrace Instruments for help in analysis of different matrices.



## 7.5.2

## Thin (Filter) Samples

The Thin Samples application is for analysis of thin samples such as filters or wipes. The detection limits are affected by the thickness of the substrate. Best results are obtained on the thinnest substrates. Always use the probe safety cover when measuring thin samples. This is not only for user safety, it also ensures a controlled background environment and provides a reference signal for the automatic gain control. Probe safety covers should never be interchanged between instruments.

Filters and wipes should be prescreened before use. This will establish the background and contamination levels of the filters or wipes. Care should be used to prevent zinc oxide contamination from disposable gloves. Small 37-mm filters can be mounted between two layers of 0.2-mil thick polypropylene XRF film on 40-mm XRF cups for analysis. Larger filters can be placed on the probe with a sheet of 0.2-mil thick polypropylene XRF film between the filter and probe to prevent the window from being contaminated. Then the probe safety cover may be placed over the filter prior to analysis. Filters should be presented loaded side down and wrinkle free.

## 7.5.3

## Lead in Paint

The area selected for analysis should be smooth and representative. The Spectrace 9000 probe should be firmly on the surface to maximize instrument contact. The probe should not be moved during analysis.

When used for specimen application, e.g., on paint chips or non-backed films, remember to use the probe safety cover. In the PbK Application, you should also position a thick neutral sample, such as the quartz disk (blank), behind the specimen before closing the safety lid. Otherwise, the PbK X-rays excited in the safety cover will be sensed by the detector. In this application, do not perform the *Acquire background data* option from the list of options under the Ready screen.

## 8.0

## CALCULATIONS

The Spectrace 9000 is a direct readout instrument that does not require any calculations.

## 9.0

## QUALITY ASSURANCE/QUALITY CONTROL

## 9.1

Precision

The precision of the method is monitored by reading the low or mid SSCS selected as described in Section 6.1 at the start and end of sample analysis and after approximately every tenth sample (a daily total of seven measurements is recommended). Determining the precision around the site action level can be extremely important if the XRF results are to be used in an enforcement action. Therefore, selection of an SSCS at or near the site action level or level of concern is recommended. The sample is analyzed by the instrument for the normal field analysis time, and the results are recorded. The standard deviation for each dependent element is calculated. The relative standard deviation (RSD) of the sample mean can be used to calculate precision. The RSD should be within  $\pm 20\%$  for the data to be considered adequately precise.

## 9.1.1

## Preliminary Detection Limit (DL) and Quantitation Limit (QL)

A preliminary DL and QL is needed to give the operator an indication of the instrument's capability in the field. A low or blank SSCS sample is selected as described in Section 6.1. More than one standard may be needed to obtain low or blank concentration values for each element. Alternatively, the Teflon™ blank may be used if a blank soil sediment sample is unavailable. Disable the display thresholds to permit display of low or negative results.

The sample is measured ten times, without moving it, using the anticipated field analysis measuring time. The standard deviation of the mean for each target element is calculated (using the N-1 formula).

If the standard deviation has a fractional component, round up to the next whole number prior to calculating the DL and QL.

The definition of the DL is three times the calculated standard deviation value.

The definition of the QL is 10 times the calculated standard deviation value.

#### 9.1.2 The Method Minimum Detection Limit (MMDL) and Method Quantitation Limit (MQL)

The MMDL and MQL may be calculated from the measurement of either a low or blank SSCS, selected as described in Section 6.1, at the start and end of sample analysis, and after approximately every tenth sample (a daily total of seven measurements is recommended).

Disable the display thresholds. This will permit results less than one standard deviation (STD) to be displayed (even negatives). Measure the SSCS using the same analysis, measuring time used for the samples. Enable the display thresholds prior to analyzing the next sample.

The standard deviation of the mean for each target element is calculated. If the standard deviation has a fractional component, round up to the next whole number prior to calculating the MMDL and MQL.

The definition of the MMDL is three times the calculated standard deviation value.

The definition of the MQL is 10 times the calculated standard deviation value.

## 9.2 Reporting Results

All raw XRF data should be reported including the individual results of multiple analyses of samples and sampling points. The average and concentration range of each analysis should also be reported.

A "reported" value for each analysis or average of multiple analyses should be processed in the following manner.

1. Round the value to the same degree of significance contained in the

SSCS sample assay value (usually two) if the element's calibration has been adjusted (see Section 6.0).

2. Report all values less than or equal to the MMDL as not detected (ND).
3. Flag and note all values greater than the MMDL and less than or equal to the MQL (usually with a "J" next to the reported value).
4. Report all values above the MQL and within the linear calibration range [if the element's calibration has been adjusted (see Section 6.0)].
5. Flag and note all values above the linear calibration range (greater than the highest SSCS used in the calibration adjustment procedure) with a "\*" next to the reported value.

## 9.3 Accuracy

Accuracy, relative to a specific digestion method and elemental analysis procedure, is determined by sending an XRF analyzed sample (prepared sample cups may be submitted) out for AA or ICP analysis at a laboratory.

To do a total accuracy check, confirmation samples should be collected throughout the entire sampling effort. A minimum of 10% of the samples should be collected including a number of samples at or near the critical level. The results of the metal analysis (dependent) and the XRF analysis (independent) are evaluated with a regression analysis. The correlation coefficient ( $R^2$ ) should be 0.7 or greater. All XRF results are multiplied by the slope prior to substitution for metal analysis results in contouring, kreiging programs, or removal volume estimates.

Another very important source of potential difference between XRF and AA or ICP results is incomplete digestion of the leaching technique. Since XRF is a total elemental technique, any comparison with referee results must account for the possibility of variable extraction depending upon the extraction

method used and its ability to dissolve the mineral form in question.

### 9.3.1 Matrix Considerations

Other types of QA/QC verification should include verification that the instrument calibration is appropriate for the specific site to be assessed. This includes verification of potential multiple soil matrix types that may exist at a site. Matrix variations that affect the XRF measurement include large variations in calcium content, such as may be encountered when going from siliceous to calcareous soils, as well as variations in iron content.

## 10.0 DATA VALIDATION

### 10.1 Confirmation Samples

Confirmation samples are recommended at a minimum rate of 10%. Confirmation samples are required if QA2 data objectives have been established for site activities. Ideally, the sample cup that was analyzed by XRF should be the same sample that is sent for AA/ICP analysis. When confirming an in situ analysis, collect a sample from a 6 inch by 6 inch area for both an XRF measurement and confirmation analysis.

The XRF and metals results are analyzed with a regression analysis using either SAS™ or Statgraphics™ software with the intercept forced through zero. The correlation factor between XRF and AA/ICP data should be 0.7 or greater.

### 10.2 Recording Results

Record all results and monitoring activities in a laboratory or field notebook. Alternatively, record results electronically on a hard drive or floppy disk.

### 10.3 Downloading Stored Results and Spectra

Results (analytical reports) and spectra which have been stored in the Spectrace 9000 internal memory should be downloaded and captured in disk files on a PC (see Section 5). Spectrace Instruments provides software for this purpose. Additionally, they provide software to prepare results or spectra for importing into a spreadsheet. Refer to the instructions provided

with the programs for details on their operation.

Alternatively, other software with terminal data logging capabilities may be used to capture results and spectra to disk files.

After capturing results to a file, print a copy and save both the disk files and the printout for future reference and documentation purposes.

## 11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow USEPA, OSHA, corporate and/or any other applicable health and safety practices.

## 12.0 REFERENCES

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APPENDIX E

XRF DATA

Application:SOILS with U,Th,Ag Q044 05-27-1994

Meas Time: 6-DEC-1994 08:27:26

ID: &lt;ECAL&gt;

( ) ( )

	Value	Std. dev.
K	980.000	297.000 ppm
Ca	13950.0	381.000 ppm
CrLO	180.000	151.000 ppm
Fe	370.000	304.000 ppm
Zn	305.000	82.9000 ppm
Sr	86.0000	51.2000 ppm
Mo	172.000	30.2000 ppm
Pb	171100	1710.00 ppm
Rb	261.000	59.0000 ppm
Cd	554.000	95.4000 ppm
Sn	219.000	61.3000 ppm
Sb	140.000	42.0000 ppm
Ba	117.000	17.8000 ppm
Th	338.000	60.5000 ppm

Application:SOILS with U,Th,Ag Q044 05-27-1994

Meas Time: 6-DEC-1994 08:38:13

ID: &lt;RESCHK&gt;

( ) ( )

	Value	Std. dev.
CrHI	231.000	84.8000 ppm
K	210.000	147.000 ppm
Ca	73.0000	71.6000 ppm
Mn	1600.00	1530.00 ppm
Fe	1.59200e+06	10600.0 ppm
Zn	940.000	180.000 ppm
Mo	41.0000	19.7000 ppm
Pb	460.000	147.000 ppm
Cd	1260.00	336.000 ppm
Sb	190.000	124.000 ppm
U	7.30000	4.54000 ppm

Application:SOILS with U,Th,Ag Q044 05-27-1994

Meas Time: 6-DEC-1994 08:50:04

ID: &lt;ZERO&gt;

( ) ( )

	Value	Std. dev.
K	340.000	150.000 ppm
Ca	242.000	74.6000 ppm
CrLO	111.000	87.1000 ppm
Cu	94.0000	53.1000 ppm
Sr	10.9000	5.23000 ppm

Application: SOILS with U,Th,Ag Q044 05-27-1994  
Meas Time: 6-DEC-1994 09:13:08  
ID: <NIST-2709>  
( ) ( )

	Value	Std. dev.
CrHI	74.0000	58.1000 ppm
K	22100.0	1300.00 ppm
Ca	22180.0	915.000 ppm
Ti	3110.00	394.000 ppm
CrLO	260.000	248.000 ppm
Mn	622.000	71.4000 ppm
Fe	31360.0	246.000 ppm
Cu	45.0000	10.7000 ppm
Zn	164.000	10.4000 ppm
As	31.7000	6.66000 ppm
Sr	270.700	4.13000 ppm
Zr	156.400	2.17000 ppm
Mo	3.40000	1.02000 ppm
Pb	30.0000	3.99000 ppm
Rb	113.500	3.81000 ppm
Sb	67.0000	44.3000 ppm
Ba	680.000	45.4000 ppm
U	3.90000	2.43000 ppm
Th	4.90000	1.57000 ppm

Application: SOILS with U,Th,Ag Q044 05-27-1994  
Meas Time: 6-DEC-1994 09:37:37  
ID: <NIST2709>  
( ) ( )

	Value	Std. dev.
CrHI	187.000	60.9000 ppm
K	23000.0	1330.00 ppm
Ca	23230.0	937.000 ppm
Ti	3060.00	398.000 ppm
Mn	627.000	71.8000 ppm
Fe	31470.0	249.000 ppm
Co	147.000	66.9000 ppm
Cu	38.0000	10.6000 ppm
Zn	151.000	10.2000 ppm
As	17.6000	6.73000 ppm
Sr	272.400	4.16000 ppm
Zr	161.100	2.21000 ppm
Mo	3.80000	1.04000 ppm
Pb	41.3000	4.19000 ppm
Rb	111.000	3.80000 ppm
Ba	599.000	43.1000 ppm
U	5.90000	2.45000 ppm
Th	2.10000	1.55000 ppm

ID	TIME	Hg
G170-4	10.80	67 B
G170-6.5	11.38	U
E210-1.5	11.78	U
E90-7	12.19	U
D130-7	12.54	U
D190-2	13.49	U
B70-3	14.34	U
B130-1	14.74	U
BB-2	15.52	U
B160-1	15.86	U
UNKNOWN	16.51	U
G70-0.5	16.94	U
G70-1.5	17.28	168
DD-5.5	17.63	U

NIST2709	9.22	0
NIST2709	9.63	0
NIST2709	10.44	0
NIST2709	13.87	-17.1
NIST2709	15.10	-26.7
NIST2709	17.96	-21.1



Application: SOILS with U, Th, Ag Q044 05-27-1994

Meas Time: 6-DEC-1994 10:26:32

ID: &lt;&gt;

( ) ( )

	Value	Std. dev.
CrHI	205.000	61.4000 ppm
K	24600.0	1370.00 ppm
Ca	22790.0	934.000 ppm
Ti	3050.00	421.000 ppm
Mn	715.000	73.6000 ppm
Fe	31570.0	251.000 ppm
Cu	30.0000	10.5000 ppm
Zn	150.000	10.2000 ppm
As	32.9000	6.69000 ppm
Sr	272.500	4.17000 ppm
Zr	160.400	2.21000 ppm
Mo	3.70000	1.04000 ppm
Pb	28.3000	3.99000 ppm
Rb	113.400	3.85000 ppm
Ba	510.000	40.2000 ppm
U	5.50000	2.45000 ppm
Th	4.50000	1.57000 ppm

Application:SOILS with U,Th,Ag Q044 05-27-1994

Meas Time: 6-DEC-1994 10:48:09

ID: &lt;G170-4&gt;

( ) ( )

	Value	Std. dev.
K	18100.0	1220.00 ppm
Ca	59600.0	1430.00 ppm
Ti	3250.00	413.000 ppm
Mn	441.000	69.4000 ppm
Fe	20090.0	190.000 ppm
Cu	29.0000	10.5000 ppm
Zn	116.000	9.89000 ppm
As	8.40000	6.46000 ppm
Sr	90.7000	2.51000 ppm
Zr	358.200	3.23000 ppm
Mo	4.30000	1.18000 ppm
Hg	67.0000	9.23000 ppm
Pb	30.4000	4.04000 ppm
Rb	94.4000	3.65000 ppm
Ba	271.000	31.6000 ppm
U	6.60000	2.39000 ppm
Th	2.70000	1.59000 ppm

Application: SOILS with U,Th,Ag Q044 05-27-1994

Meas Time: 6-DEC-1994 11:22:30

ID: &lt;G170-6.5&gt;

( ) ( )

	Value	Std. dev.
CrHI	131.000	65.0000 ppm
K	28100.0	1460.00 ppm
Ca	42500.0	1250.00 ppm
Ti	3380.00	417.000 ppm
Mn	1747.00	95.5000 ppm
Fe	30840.0	257.000 ppm
Cu	52.0000	11.5000 ppm
Zn	131.000	10.4000 ppm
As	7.50000	6.71000 ppm
Sr	73.8000	2.38000 ppm
Zr	249.300	2.70000 ppm
Mo	5.20000	1.17000 ppm
Pb	29.6000	4.25000 ppm
Rb	114.100	4.00000 ppm
Ba	311.000	34.8000 ppm
U	7.30000	2.43000 ppm
Th	5.60000	1.56000 ppm

100151

Application:SOILS with U,Th,Ag Q044 05-27-1994

Meas Time: 6-DEC-1994 11:46:52

ID: &lt;E210-1.5&gt;

( ) ( )

	Value	Std. dev.
CrHI	245.000	61.5000 ppm
K	19000.0	1210.00 ppm
Ca	9260.00	622.000 ppm
Ti	4190.00	402.000 ppm
Mn	1521.00	86.3000 ppm
Fe	27540.0	219.000 ppm
Cu	14.2000	9.68000 ppm
Zn	102.100	9.15000 ppm
As	21.3000	6.45000 ppm
Sr	63.9000	2.11000 ppm
Zr	393.200	3.20000 ppm
Mo	7.80000	1.19000 ppm
Pb	36.6000	3.96000 ppm
Rb	64.2000	3.16000 ppm
Sb	61.0000	47.8000 ppm
Ba	173.000	26.2000 ppm
Ag	144.000	82.7000 ppm
U	11.5000	2.32000 ppm
Th	2.10000	1.59000 ppm

Application:SOILS with U,Th,Ag Q044 05-27-1994

Meas Time: 6-DEC-1994 12:11:23

ID: &lt;&gt;

( ) ( )

	Value	Std. dev.
CrHI	92.0000	55.5000 ppm
K	3590.00	746.000 ppm
Ca	62400.0	1410.00 ppm
Ti	1310.00	255.000 ppm
CrLO	450.000	229.000 ppm
Mn	658.000	61.6000 ppm
Fe	7330.00	104.000 ppm
Cu	103.000	12.1000 ppm
Zn	130.000	11.0000 ppm
As	32.8000	7.17000 ppm
Sr	90.8000	2.38000 ppm
Zr	89.5000	1.55000 ppm
Mo	6.40000	1.08000 ppm
Pb	39.9000	4.18000 ppm
Rb	14.0000	3.08000 ppm
Ba	14.0000	12.9000 ppm
U	80.6000	2.92000 ppm

100153

Application:SOILS with U,Th,Ag Q044 05-27-1994

Meas Time: 6-DEC-1994 12:32:05

ID: &lt;D130-7&gt;

( ) ( )

	Value	Std. dev.
CrHI	175.000	57.6000 ppm
K	12600.0	1030.00 ppm
Ca	22650.0	897.000 ppm
Ti	2810.00	365.000 ppm
CrLO	530.000	253.000 ppm
Mn	587.000	63.0000 ppm
Fe	13120.0	139.000 ppm
Cu	48.0000	11.1000 ppm
Zn	142.000	11.1000 ppm
As	12.2000	6.94000 ppm
Sr	73.9000	2.16000 ppm
Zr	194.200	2.13000 ppm
Pb	38.9000	4.25000 ppm
Rb	66.7000	3.20000 ppm
Ba	80.0000	18.7000 ppm
Ag	119.000	67.8000 ppm
U	18.2000	2.57000 ppm
Th	10.6000	1.76000 ppm

Application: SOILS with U,Th,Ag Q044 05-27-1994

Meas Time: 6-DEC-1994 13:29:29

ID: &lt;D190-2&gt;

( ) ( )

	Value	Std. dev.
CrHI	257.000	62.8000 ppm
K	30000.0	1490.00 ppm
Ca	4570.00	519.000 ppm
Ti	4180.00	406.000 ppm
CrLO	110.000	220.000 ppm
Mn	1771.00	92.7000 ppm
Fe	34850.0	270.000 ppm
Co	40.0000	69.1000 ppm
Ni	-69.0000	18.5000 ppm
Cu	33.0000	10.6000 ppm
Zn	163.000	10.5000 ppm
As	8.20000	6.81000 ppm
Se	-16.1000	3.86000 ppm
Sr	72.6000	2.29000 ppm
Zr	314.000	2.96000 ppm
Mo	2.50000	1.14000 ppm
Hg	-38.0000	7.26000 ppm
Pb	48.4000	4.36000 ppm
Rb	111.200	3.86000 ppm
Cd	53.0000	131.600 ppm
Sn	130.000	81.6000 ppm
Sb	-27.0000	46.2000 ppm
Ba	297.000	33.0000 ppm
Ag	-7.60000	79.8900 ppm
U	7.70000	2.44000 ppm
Th	3.80000	1.59000 ppm

Application:SOILS with U,Th,Ag Q044 05-27-1994

Meas Time: 6-DEC-1994 13:52:06

ID: &lt;NIST2709&gt;

( ) ( )

	Value	Std. dev.
CrHI	173.000	58.6000 ppm
K	22500.0	1320.00 ppm
Ca	23440.0	939.000 ppm
Ti	3500.00	413.000 ppm
CrLO	110.000	238.000 ppm
Mn	632.000	70.5000 ppm
Fe	31690.0	249.000 ppm
Co	-83.0000	65.3000 ppm
Ni	28.0000	20.0000 ppm
Cu	29.0000	10.5000 ppm
Zn	167.000	10.5000 ppm
As	23.5000	6.76000 ppm
Se	-15.3000	3.85000 ppm
Sr	271.700	4.15000 ppm
Zr	156.300	2.18000 ppm
Mo	3.30000	1.03000 ppm
Hg	-17.1000	7.65000 ppm
Pb	37.8000	4.19000 ppm
Rb	114.900	3.87000 ppm
Cd	-160.000	110.000 ppm
Sn	16.0000	70.4000 ppm
Sb	36.0000	42.3000 ppm
Ba	647.000	44.6000 ppm
Ag	66.0000	74.0000 ppm
U	6.70000	2.47000 ppm
Th	6.40000	1.59000 ppm



Application:SOILS with U,Th,Ag Q044 05-27-1994

Meas Time: 6-DEC-1994 14:20:25

ID: &lt;B70-3&gt;

( ) ( )

	Value	Std. dev.
CrHI	163.000	56.8000 ppm
K	16800.0	1140.00 ppm
Ca	3540.00	429.000 ppm
Ti	4130.00	386.000 ppm
CrLO	520.000	229.000 ppm
Mn	1110.00	76.3000 ppm
Fe	21210.0	182.000 ppm
Co	21.0000	53.4000 ppm
Ni	-62.0000	16.1000 ppm
Cu	2.00000	8.94000 ppm
Zn	128.600	9.25000 ppm
As	11.6000	5.82000 ppm
Se	-11.3000	3.53000 ppm
Sr	63.7000	2.02000 ppm
Zr	376.700	3.02000 ppm
Mo	5.60000	1.11000 ppm
Hg	-22.2000	6.73000 ppm
Pb	25.0000	3.60000 ppm
Rb	78.2000	3.18000 ppm
Cd	-92.0000	113.300 ppm
Sn	-15.0000	68.9000 ppm
Sb	42.0000	43.4000 ppm
Ba	202.000	26.7000 ppm
Ag	63.0000	74.3000 ppm
U	8.00000	2.40000 ppm
Th	5.50000	1.65000 ppm

100157

Application:SOILS with U,Th,Ag Q044 05-27-1994

Meas Time: 6-DEC-1994 14:44:13

ID: &lt;B130-1&gt;

( ) ( )

	Value	Std. dev.
CrHI	192.000	60.1000 ppm
K	18700.0	1210.00 ppm
Ca	21050.0	885.000 ppm
Ti	4120.00	412.000 ppm
CrLO	250.000	237.000 ppm
Mn	1124.00	79.6000 ppm
Fe	25920.0	214.000 ppm
Co	-103.000	58.9000 ppm
Ni	-45.0000	17.7000 ppm
Cu	75.0000	11.2000 ppm
Zn	97.7000	9.32000 ppm
As	2.70000	8.52000 ppm
Se	-12.1000	3.84000 ppm
Sr	82.2000	2.35000 ppm
Zr	329.500	2.96000 ppm
Mo	5.00000	1.14000 ppm
Hg	-5.40000	7.67000 ppm
Pb	150.100	5.95000 ppm
Rb	79.3000	3.37000 ppm
Cd	22.0000	124.700 ppm
Sn	238.000	82.4000 ppm
Sb	9.80000	45.7900 ppm
Ba	276.000	31.3000 ppm
Ag	64.0000	79.4000 ppm
U	8.20000	2.36000 ppm
Th	5.20000	1.70000 ppm

100158

Application:SOILS with U,Th,Ag Q044 05-27-1994-

Meas Time: 6-DEC-1994 15:06:15

ID: &lt;NIST-2709&gt;

( ) ( )

	Value	Std. dev.
CrHI	187.000	58.4000 ppm
K	22900.0	1330.00 ppm
Ca	23220.0	937.000 ppm
Ti	2690.00	413.000 ppm
CrLO	-170.000	242.000 ppm
Mn	775.000	72.9000 ppm
Fe	31640.0	250.000 ppm
Co	15.0000	66.0000 ppm
Ni	-17.0000	19.2000 ppm
Cu	50.0000	10.9000 ppm
Zn	144.000	10.1000 ppm
As	20.7000	6.63000 ppm
Se	-17.8000	3.80000 ppm
Sr	286.000	4.26000 ppm
Zr	160.500	2.21000 ppm
Mo	6.00000	1.05000 ppm
Hg	-26.7000	7.44000 ppm
Pb	34.2000	4.10000 ppm
Rb	117.000	3.86000 ppm
Cd	79.0000	117.600 ppm
Sn	7.60000	70.1100 ppm
Sb	12.0000	43.4000 ppm
Ba	585.000	42.7000 ppm
Ag	112.000	76.1000 ppm
U	1.90000	2.44000 ppm
Th	6.00000	1.58000 ppm

100159

Application:SOILS with U,Th,Ag Q044 05-27-1994

Meas Time: 6-DEC-1994 15:31:18

ID: &lt;BB-2&gt;

( ) ( )

	Value	Std. dev.
CrHI	122.000	58.7000 ppm
K	30200.0	1500.00 ppm
Ca	5840.00	561.000 ppm
Ti	4820.00	432.000 ppm
CrLO	-25.0000	216.000 ppm
Mn	1236.00	83.4000 ppm
Fe	30920.0	250.000 ppm
Co	9.30000	65.0400 ppm
Ni	-31.0000	18.8000 ppm
Cu	77.0000	11.5000 ppm
Zn	223.000	11.3000 ppm
As	-5.40000	7.39000 ppm
Se	-17.0000	3.80000 ppm
Sr	75.5000	2.31000 ppm
Zr	355.700	3.16000 ppm
Mo	5.30000	1.18000 ppm
Hg	-28.5000	7.34000 ppm
Pb	88.8000	5.02000 ppm
Rb	94.8000	3.63000 ppm
Cd	-170.000	124.000 ppm
Sn	-80.0000	74.5000 ppm
Sb	103.000	50.2000 ppm
Ba	315.000	33.3000 ppm
Ag	135.000	85.1000 ppm
U	8.70000	2.42000 ppm
Th	2.70000	1.62000 ppm

Application: SOILS with U,Th,Ag Q044 05-27-1994

Meas Time: 6-DEC-1994 15:51:23

ID: &lt;B160-1&gt;

( ) ( )

	Value	Std. dev.
CrHI	96.0000	53.4000 ppm
K	14800.0	1080.00 ppm
Ca	8160.00	576.000 ppm
Ti	3450.00	347.000 ppm
CrLO	-93.0000	167.800 ppm
Mn	942.000	71.8000 ppm
Fe	20500.0	177.000 ppm
Co	-12.0000	52.3000 ppm
Ni	-88.0000	15.4000 ppm
Cu	25.0000	9.48000 ppm
Zn	162.500	9.83000 ppm
As	13.3000	7.12000 ppm
Se	-17.6000	3.45000 ppm
Sr	64.7000	2.04000 ppm
Zr	326.800	2.77000 ppm
Mo	3.80000	1.05000 ppm
Hg	-21.1000	6.80000 ppm
Pb	88.7000	4.70000 ppm
Rb	69.6000	3.04000 ppm
Cd	-19.0000	110.500 ppm
Sn	-53.0000	64.9000 ppm
Sb	-9.70000	39.5800 ppm
Ba	198.000	26.1000 ppm
Ag	112.000	73.6000 ppm
U	6.30000	2.32000 ppm
Th	3.70000	1.64000 ppm

100161

Application:SOILS with U,Th,Ag Q044 05-27-1994

Meas Time: 6-DEC-1994 16:30:34

ID: &lt;DD-5.5&gt;

( ) ( )

	Value	Std. dev.
CrHI	112.000	57.6000 ppm
K	17600.0	1180.00 ppm
Ca	20460.0	869.000 ppm
Ti	3960.00	385.000 ppm
CrLO	500.000	236.000 ppm
Mn	1407.00	83.4000 ppm
Fe	25750.0	212.000 ppm
Co	-75.0000	58.9000 ppm
Ni	-55.0000	17.4000 ppm
Cu	35.0000	10.3000 ppm
Zn	200.000	10.9000 ppm
As	-1.00000	8.48000 ppm
Se	-16.6000	3.76000 ppm
Sr	75.6000	2.27000 ppm
Zr	304.700	2.81000 ppm
Mo	0.900000	1.08000 ppm
Hg	5.80000	7.89000 ppm
Pb	152.000	5.92000 ppm
Rb	82.1000	3.39000 ppm
Cd	19.0000	129.000 ppm
Sn	-56.0000	74.6000 ppm
Sb	65.0000	49.9000 ppm
Ba	274.000	31.3000 ppm
Ag	65.0000	82.2000 ppm
U	8.80000	2.37000 ppm
Th	4.70000	1.69000 ppm

Application:SOILS with U,Th,Ag Q044 05-27-1994

Meas Time: 6-DEC-1994 16:56:11

ID: &lt;G70-0.5&gt;

( ) ( )

	Value	Std. dev.
CrHI	81.0000	55.4000 ppm
K	18700.0	1210.00 ppm
Ca	17500.0	814.000 ppm
Ti	3700.00	371.000 ppm
CrLO	190.000	212.000 ppm
Mn	1016.00	75.9000 ppm
Fe	26160.0	214.000 ppm
Co	-77.0000	59.0000 ppm
Ni	-41.0000	17.6000 ppm
Cu	23.7000	9.98000 ppm
Zn	224.000	11.1000 ppm
As	-2.80000	8.23000 ppm
Se	-18.7000	3.66000 ppm
Sr	70.6000	2.20000 ppm
Zr	275.500	2.65000 ppm
Mo	3.20000	1.07000 ppm
Hg	10.5000	7.88000 ppm
Pb	142.600	5.73000 ppm
Rb	81.5000	3.36000 ppm
Cd	-120.000	122.000 ppm
Sn	66.0000	77.1000 ppm
Sb	-4.70000	44.1000 ppm
Ba	312.000	32.6000 ppm
Ag	36.0000	79.1000 ppm
U	8.10000	2.34000 ppm
Th	2.10000	1.63000 ppm

100163

Application:SOILS with U,Th,Ag Q044 05-27-1994

Meas Time: 6-DEC-1994 17:16:58

ID: &lt;G70-1.5&gt;

( ) ( )

	Value	Std. dev.
CrHI	200.000	62.5000 ppm
K	18800.0	1230.00 ppm
Ca	46700.0	1280.00 ppm
Ti	4560.00	397.000 ppm
CrLO	-95.0000	185.300 ppm
Mn	734.000	73.9000 ppm
Fe	24470.0	213.000 ppm
Co	27.0000	60.1000 ppm
Ni	-59.0000	18.1000 ppm
Cu	26.0000	10.5000 ppm
Zn	324.000	12.9000 ppm
As	4.10000	7.34000 ppm
Se	-14.3000	3.97000 ppm
Sr	89.5000	2.53000 ppm
Zr	225.300	2.49000 ppm
Mo	4.30000	1.09000 ppm
Hg	168.000	10.9000 ppm
Pb	73.9000	4.85000 ppm
Rb	97.2000	3.67000 ppm
Cd	120.000	144.000 ppm
Sn	-8.40000	83.0500 ppm
Sb	-47.0000	49.7000 ppm
Ba	327.000	34.7000 ppm
Ag	25.0000	88.2000 ppm
U	7.50000	2.40000 ppm
Th	3.80000	1.58000 ppm



100164

Application:SOILS with U,Th,Ag Q044 05-27-1994

Meas Time: 6-DEC-1994 17:37:48

ID: &lt;DD-5.5&gt;

( ) ( )

	Value	Std. dev.
CrHI	147.000	57.3000 ppm
K	9740.00	960.000 ppm
Ca	46800.0	1250.00 ppm
Ti	2310.00	316.000 ppm
CrLO	270.000	230.000 ppm
Mn	393.000	58.1000 ppm
Fe	12880.0	140.000 ppm
Co	86.0000	47.3000 ppm
Ni	-71.0000	17.5000 ppm
Cu	59.0000	11.7000 ppm
Zn	136.000	11.4000 ppm
As	31.1000	7.38000 ppm
Se	-9.90000	4.19000 ppm
Sr	73.0000	2.21000 ppm
Zr	132.500	1.83000 ppm
Mo	5.50000	1.09000 ppm
Hg	-18.6000	7.99000 ppm
Pb	37.6000	4.37000 ppm
Rb	39.4000	3.27000 ppm
Cd	25.0000	99.4000 ppm
Sn	-66.0000	56.6000 ppm
Sb	-36.0000	33.7000 ppm
Ba	44.0000	16.1000 ppm
Ag	83.0000	65.0000 ppm
U	53.0000	2.77000 ppm
Th	3.10000	1.68000 ppm

Application: SOILS with U,Th,Ag Q044 05-27-1994  
Meas Time: 6-DEC-1994 17:57:30  
ID: <NIST2709>

( ) ( )

	Value	Std. dev.
CrHI	91.0000	55.3000 ppm
K	23700.0	1350.00 ppm
Ca	21390.0	905.000 ppm
Ti	3010.00	410.000 ppm
CrLO	120.000	249.000 ppm
Mn	676.000	70.5000 ppm
Fe	31650.0	250.000 ppm
Co	102.000	66.6000 ppm
Ni	-35.0000	18.9000 ppm
Cu	18.0000	10.2000 ppm
Zn	164.000	10.4000 ppm
As	23.0000	6.52000 ppm
Se	-27.6000	3.61000 ppm
Sr	268.200	4.12000 ppm
Zr	159.700	2.19000 ppm
Mo	2.80000	1.01000 ppm
Hg	-21.1000	7.57000 ppm
Pb	29.0000	3.92000 ppm
Rb	113.600	3.83000 ppm
Cd	22.0000	116.700 ppm
Sn	186.000	77.5000 ppm
Sb	35.0000	44.4000 ppm
Ba	-573.000	42.4000 ppm
Ag	118.000	76.8000 ppm
U	3.30000	2.42000 ppm
Th	4.00000	1.55000 ppm

100166

Application:SOILS with U,Th,Ag q044 05-27-1994

Meas Time: 7-DEC-1994 11:41:30

ID: &lt;NIST2709&gt;

( ) ( )

	Value	Std. dev.
CrHI	189.000	59.4000 ppm
K	22200.0	1310.00 ppm
Ca	23260.0	935.000 ppm
Ti	3520.00	420.000 ppm
CrLO	140.000	246.000 ppm
Mn	791.000	73.9000 ppm
Fe	32190.0	252.000 ppm
Co	170.000	67.8000 ppm
Ni	-13.0000	19.7000 ppm
Cu	38.0000	10.7000 ppm
Zn	139.000	10.1000 ppm
As	26.0000	6.56000 ppm
Se	-17.3000	3.82000 ppm
Sr	261.700	4.08000 ppm
Zr	161.900	2.20000 ppm
Mo	4.90000	1.05000 ppm
Hg	-35.6000	7.28000 ppm
Pb	28.0000	3.92000 ppm
Rb	118.000	3.91000 ppm
Cd	-44.0000	112.600 ppm
Sn	103.000	72.6000 ppm
Sb	-63.0000	36.9000 ppm
Ba	556.000	41.7000 ppm
Ag	44.0000	72.0000 ppm
U	6.40000	2.48000 ppm
Th	0.800000	1.52000 ppm

100167

Application:SOILS with U,Th,Ag q044 05-27-1994

Meas Time: 7-DEC-1994 12:03:38

ID: &lt;NIST-2709&gt;

( ) ( )

	Value	Std. dev.	
CrHI	318.000	63.4000	ppm
K	27200.0	1430.00	ppm
Ca	21840.0	924.000	ppm
Ti	3540.00	416.000	ppm
CrLO	-99.0000	230.700	ppm
Mn	795.000	75.2000	ppm
Fe	32270.0	258.000	ppm
Co	101.000	67.8000	ppm
Ni	-30.0000	19.4000	ppm
Cu	17.0000	10.3000	ppm
Zn	142.000	10.2000	ppm
As	13.1000	6.79000	ppm
Se	-23.1000	3.77000	ppm
Sr	270.900	4.19000	ppm
Zr	167.800	2.27000	ppm
Mo	4.00000	1.06000	ppm
Hg	-12.6000	7.86000	ppm
Pb	42.6000	4.27000	ppm
Rb	116.100	3.90000	ppm
Cd	-55.0000	114.600	ppm
Sn	-13.0000	68.8000	ppm
Sb	-56.0000	38.1000	ppm
Ba	595.000	43.2000	ppm
Ag	-5.70000	70.9400	ppm
U	4.20000	2.45000	ppm
Th	4.70000	1.58000	ppm

100168

Application:SOILS with U,Th,Ag Q044 05-27-1994

Meas Time: 7-DEC-1994 08:47:59

ID: &lt;ZERO&gt;

( ) ( )

	Value	Std. dev.
CrHI	-220.000	251.000 ppm
K	44.0000	136.700 ppm
Ca	2.50000	63.9900 ppm
Ti	-63.0000	52.3000 ppm
CrLO	211.000	89.4000 ppm
Mn	540.000	247.000 ppm
Fe	-78.0000	127.300 ppm
Co	-47.0000	115.200 ppm
Ni	35.0000	76.5000 ppm
Cu	-52.0000	44.5000 ppm
Zn	-47.0000	46.8000 ppm
As	9.40000	30.1000 ppm
Se	3.10000	18.6000 ppm
Sr	3.60000	4.84000 ppm
Zr	7.00000	3.21000 ppm
Mo	-0.300000	3.59000 ppm
Hg	53.0000	37.6000 ppm
Pb	7.10000	16.8200 ppm
Rb	-0.200000	9.25000 ppm
Cd	118.000	53.1000 ppm
Sn	-31.0000	30.3000 ppm
Sb	-22.0000	19.0000 ppm
Ba	9.20000	6.94000 ppm
Ag	-25.0000	32.1000 ppm
U	11.0000	10.7000 ppm
Th	-2.80000	7.86000 ppm

Application:SOILS with U,Th,Ag Q044 05-27-1994

Meas Time: 7-DEC-1994 09:10:58

ID: &lt;NIST2709&gt;

( ) ( )

	Value	Std. dev.
CrHI	255.000	62.6000 ppm
K	25300.0	1390.00 ppm
Ca	21870.0	918.000 ppm
Ti	2710.00	402.000 ppm
CrLO	-200.000	227.000 ppm
Mn	629.000	72.2000 ppm
Fe	31410.0	251.000 ppm
Co	186.000	67.2000 ppm
Ni	-49.0000	18.8000 ppm
Cu	29.0000	10.4000 ppm
Zn	152.000	10.2000 ppm
As	17.8000	6.46000 ppm
Se	-22.2000	3.71000 ppm
Sr	270.600	4.15000 ppm
Zr	163.200	2.22000 ppm
Mo	1.10000	1.01000 ppm
Hg	-11.5000	7.73000 ppm
Pb	31.7000	3.92000 ppm
Rb	113.800	3.84000 ppm
Cd	-160.000	107.000 ppm
Sn	-139.000	60.8000 ppm
Sb	32.0000	40.8000 ppm
Ba	630.000	43.8000 ppm
Ag	-26.0000	67.1000 ppm
U	6.00000	2.45000 ppm
Th	3.30000	1.56000 ppm

Application:SOILS with U,Th,Ag 0044 05-27-1994

Meas Time: 7-DEC-1994 09:30:40

ID: &lt;NIST2709&gt;

( ) ( )

	Value	Std. dev.
CrHI	249.000	62.3000 ppm
K	21600.0	1290.00 ppm
Ca	22050.0	912.000 ppm
Ti	3690.00	419.000 ppm
CrLO	100.000	241.000 ppm
Mn	730.000	73.6000 ppm
Fe	31430.0	247.000 ppm
Co	143.000	66.7000 ppm
Ni	-28.0000	19.1000 ppm
Cu	22.0000	10.2000 ppm
Zn	149.000	10.1000 ppm
As	16.3000	6.51000 ppm
Se	-21.5000	3.70000 ppm
Sr	274.100	4.16000 ppm
Zr	155.000	2.17000 ppm
Mo	4.50000	1.02000 ppm
Hg	-18.3000	7.57000 ppm
Pb	34.0000	4.03000 ppm
Rb	113.500	3.82000 ppm
Cd	-48.0000	109.700 ppm
Sn	129.000	71.8000 ppm
Sb	-11.0000	39.3000 ppm
Ba	512.000	40.0000 ppm
Ag	-0.200000	68.1100 ppm
U	3.90000	2.43000 ppm
Th	4.40000	1.57000 ppm

Application:SOILS with U,Th,Ag 0044 05-27-1994

Meas Time: 7-DEC-1994 08:32:02

ID: &lt;ECAL&gt;

( ) ( )

	Value	Std. dev.
CrHI	22.0000	685.600 ppm
K	1370.00	310.000 ppm
Ca	14240.0	386.000 ppm
Ti	61.0000	87.6000 ppm
CrLO	460.000	158.000 ppm
Mn	420.000	586.000 ppm
Fe	980.000	334.000 ppm
Co	110.000	231.000 ppm
Ni	110.000	167.000 ppm
Cu	200.000	106.000 ppm
Zn	153.000	77.1000 ppm
As	-6220.00	982.000 ppm
Se	-290.000	100.000 ppm
Sr	68.0000	50.5000 ppm
Zr	-204.000	56.0000 ppm
Mo	120.000	30.1000 ppm
Hg	-67.0000	129.500 ppm
Pb	170900	1710.00 ppm
Rb	264.000	60.0000 ppm
Cd	587.000	95.8000 ppm
Sn	317.000	65.0000 ppm
Sb	170.000	43.5000 ppm
Ba	92.0000	16.3000 ppm
Ag	87.0000	48.8000 ppm
U	-79.0000	24.4000 ppm
Th	275.000	60.0000 ppm

Application:SOILS with U,Th,Ag 0044 05-27-1994

Meas Time: 7-DEC-1994 08:41:15

ID: &lt;RESCHK&gt;

( ) ( )

	Value	Std. dev.
CrHI	117.000	81.2000 ppm
K	190.000	142.000 ppm
Ca	138.000	70.4000 ppm
Ti	-116.000	58.0000 ppm
CrLO	-46.0000	85.7000 ppm
Mn	2000.00	1530.00 ppm
Fe	1.58900e+06	10600.0 ppm
Co	-5300.00	2880.00 ppm
Ni	740.000	1341.00 ppm
Cu	180.000	320.000 ppm
Zn	990.000	186.000 ppm
As	-31.0000	206.400 ppm
Se	-6.50000	76.3700 ppm
Sr	-13.0000	31.8000 ppm
Zr	45.0000	21.8000 ppm
Mo	8.10000	20.6500 ppm
Hg	-410.000	221.000 ppm
Pb	500.000	152.000 ppm
Rb	31.0000	71.5000 ppm
Cd	1030.00	333.000 ppm
Sn	550.000	198.000 ppm
Sb	320.000	127.000 ppm
Ba	47.0000	36.2000 ppm
Ag	-430.000	177.000 ppm
U	16.3000	5.40000 ppm
Th	-11.8000	4.36000 ppm

Application:SOILS with U,Th,Ag Q044 05-27-1994

Meas Time: 7-DEC-1994 14:27:56

ID: &lt;&gt;

( ) ( )

	Value	Std. dev.
CrHI	207.000	59.7000 ppm
K	25200.0	1380.00 ppm
Ca	23590.0	950.000 ppm
Tl	3330.00	415.000 ppm
CrLO	180.000	252.000 ppm
Mn	779.000	74.0000 ppm
Fe	32160.0	256.000 ppm
Co	133.000	67.9000 ppm
Ni	-44.0000	19.1000 ppm
Cu	52.0000	11.1000 ppm
Zn	144.000	10.3000 ppm
As	20.2000	6.76000 ppm
Se	-18.7000	3.85000 ppm
Sr	274.000	4.20000 ppm
Zr	167.900	2.26000 ppm
Mo	3.50000	1.05000 ppm
Hg	-23.3000	7.64000 ppm
Pb	37.0000	4.16000 ppm
Rb	119.100	3.93000 ppm
Cd	210.000	124.000 ppm
Sn	-8.90000	70.1100 ppm
Sb	32.0000	46.7000 ppm
Ba	607.000	43.8000 ppm
Ag	40.0000	74.0000 ppm
U	3.90000	2.46000 ppm
Th	2.70000	1.56000 ppm



APPENDIX F  
XRF LOG ENTRIES

December 6, 1964 - pyridium mercury sink  
 Runtime cd 60 Fe 60 Am 60

Ecal

~~Theoretical~~

measured

Stats

Cal 109 PbL2	10.54	10.539	$\pm 0.040$
PbL6	12.61	12.632	$\pm 0.040$
PbL2	14.76	14.774	$\pm 0.040$
Emission PK	22.10	22.116	$\pm 0.040$
Fe 55 SKX	2.31	2.3142	$\pm 0.010$
Emission PK	5.89	5.8997	$\pm 0.010$
Am 241 PbL2	10.54	10.513	$\pm 0.050$
PbL8	12.61	12.605	$\pm 0.050$
Emission PK	59.5	59.495	$\pm 0.30$

OK

Reschik

max 2387

 $\frac{1}{2}$  max 1693

R&amp;L (KW) 6.47 -

L sol (KW) 6.29

6.47 -

6.29

= 0.18

Stats  $\pm 0.30$  OK

zero OK

~~Drop~~

Runtime cd 1000

Fe-10

Am-10

Sample #

Hg Value

Qualifier

NIST 2709\*

0

—

NIST 2709\*

0

—

NIST 2709\*

0

—

G170-6.5

0

ND

E210-1.5

0

ND

unlabeled E90-7

0

ND

1215

Sample #

H<sub>g</sub> Value Qualifier

/	D130-7	<del>130</del> -30.9	ND
/	D190-2	-38.0	ED
/	NIST 2709	-11.7.4	-
/	B70-3	-22.2	ND
/	B130-1	-5.4	ED
/	NIST 2709	-26.7	-
/	B-B-2	-38.5	ED
/	B160-1	-21.1	ED
/	<del>DD-5.5-?</del> (PZ)		-
/	<del>DD-5.5</del> (unknown)	5.8	ED
/	G-70-0.5	0.5	ED
/	<del>G-70-0.5</del>	<del>16.8</del>	
/	TD 5.5	-18.6	ND
/	NIST 2709	-21.1	ND

December 7, 1994 - Pyridium mercury #2

Run time Cd-60 Fe-60 - Am-60

ECAL Th<sub>cor</sub> merged Specs

Cd104	Pb2 $\alpha$	10.54	10.552	$\pm 0.040$
	PbL $\beta$	12.61	12.629	$\pm 0.040$
	PbL $\gamma$	14.76	14.770	$\pm 0.040$
	Emission PK	22.10	22.110	$\pm 0.040$
Fe55	S-K $\alpha$	2.31	2.301	EO. 010
	Emission PK	5.89	5.8940	$\pm 0.010$
Am241	PbL $\alpha$	10.54	10.549	$\pm 0.050$
	PbL $\beta$	12.61	12.602	$\pm 0.050$
	Emission PK	59.50	59.439	$\pm 0.20$

RPSCHK

max 2412

1/2 max 1206

R side (kev) 6.50

- L side (kev) 6.26

100175

December 7 1944 - Pyridium mercury #2

6.50 - 6.26 = 0.24

specs  $\pm 0.30$  OK

0.0 ND

8.0 ID

7.1 -

2.2 ID

5.4 ID

6.7 -

Zero OK

2.5 ID

0.1 ID

-

0.8 ID

0.5 ID

0.0 ID

3.6 ID

0.1 ID

Run time 1000 10 Fe 10 Am

Sample # Hg Value Qualifier

NIST 2709 - 11.5 -

NIST 2709 - 18.3 -

A1 1.5-2.0 - 1.7 ID

A2 0-1.5 7.2 ID

B1 1.5-3.0 - 13.7 ID

C1 3.0-5.0 - 15.6 ID

B2 1.5-2.0 - 12.1 ID

NIST 2709 - 35.6 -

NIST 2709 - 12.6 -

C3 1.0-1.5 - 10.4 ID

B3 1.0-2.0 - 22.9 ID

A3 1.5-2.0 - 17.0 ID

D2 2-2.6 - 26.8 ID

D1 2.0 - 9.1 ID

NIST 2709 - 23.3 -

Long #2

60

0.040

0.040

0.040

0.040

0.010

0.010

0.050

0.050

0.20

OK

N 20.775

OH-1 7.87

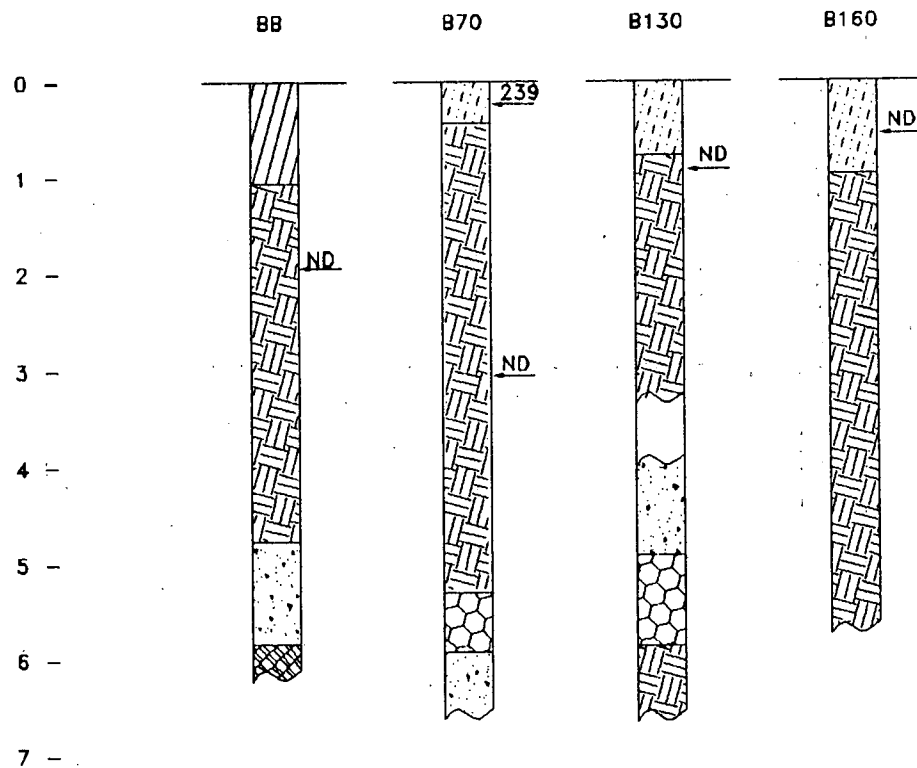
HDL 23.6

MDL 78.7







3.26

**APPENDIX G**  
**SOIL BORING CROSS SECTIONS**

DEPTH (ft)



**LEGEND:**

-  ROCK FRAGMENTS
-  PRODUCT
-  YELLOW/BROWN SILT AND SAND
-  BLACK ORGANIC SILT
-  GRAY SILT, COARSE SAND, AND CLAY
-  DARK BROWN ORGANIC SILT
- 239 SAMPLE LOCATION AND MERCURY CONCENTRATION(mg/kg)
- ND NOT DETECTED

NOT TO SCALE

**FIGURE 1 - CROSS SECTION - SAMPLE LINE B  
PYRIDIUM MERCURY DISPOSAL SITE No. 1  
HARRIMAN, NEW YORK  
DECEMBER 1994**

**US EPA REMOVAL ACTION BRANCH**  
SUPERFUND TECHNICAL ASSESSMENT AND RESPONSE TEAM  
CONTRACT# 68-WB-0019

DRW BY: J. HAMPTON JR.

EPA TASK MONITOR: E. WILSON

START PROJECT MANAGER: K. CAMPBELL

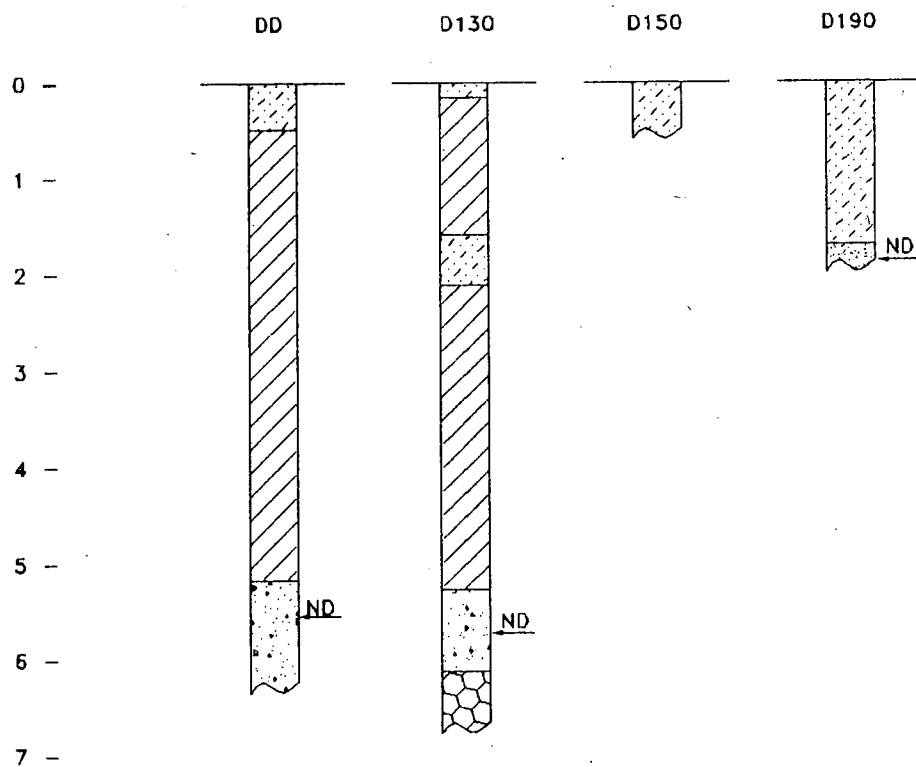


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**FEDERAL PROGRAMS DIVISION**






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C.C. JOHNSON & MALHOTRA, P.C., RESOURCE APPLICATIONS, INC.,  
R.E. SARRIERA ASSOCIATES, AND GRB ENVIRONMENTAL SERVICES, INC.

100177

DEPTH (ft)



LEGEND:

-  BROWN SAND AND SILT
-  PRODUCT
-  GRAY SILT, COARSE SAND, AND CLAY
-  DARK BROWN ORGANIC SILT
-  BLACK ORGANIC SILT
- 68 SAMPLE LOCATION AND MERCURY CONCENTRATION (mg/kg)
- ND NOT DETECTED

NOT TO SCALE

FIGURE 2 - CROSS SECTION - SAMPLE LINE D  
PYRIDIUM MERCURY DISPOSAL SITE No. 1  
HARRIMAN, NEW YORK  
DECEMBER 1994

US EPA REMOVAL ACTION BRANCH  
SUPERFUND TECHNICAL ASSESSMENT AND RESPONSE TEAM  
CONTRACT # 68-W5-0019

DRW BY: J. HAMPTON JR.

EPA TASK MONITOR: E. WILSON

START PROJECT MANAGER: K. CAMPBELL

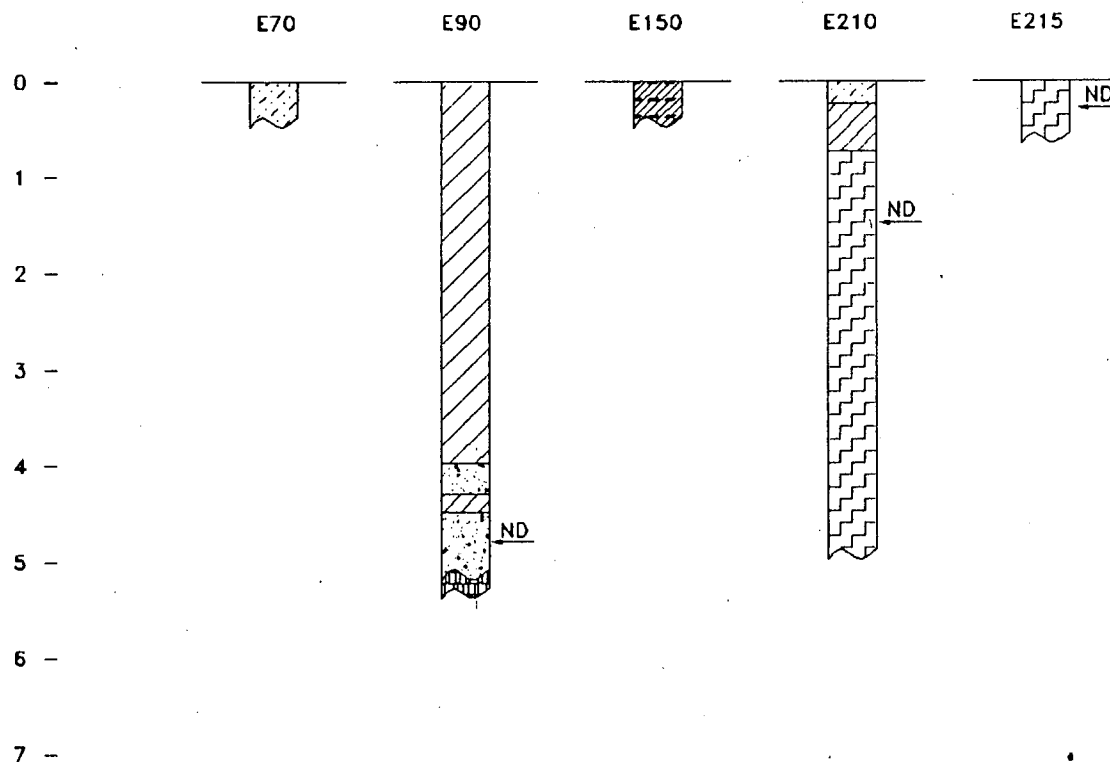


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FEDERAL PROGRAMS DIVISION








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R.E. SARRIERA ASSOCIATES, AND GRB ENVIRONMENTAL SERVICES, INC.

100178

DEPTH (ft)



LEGEND:

-  DARK BROWN ORGANIC SILT
-  PRODUCT
-  STRONG BROWN FINE SAND AND SILT
-  GRAVEL, WOOD CHIPS, AND BROWN ORGANIC SILT
-  BLACK ORGANIC SILT
-  ROCK FRAGMENTS
-  68 SAMPLE LOCATION AND MERCURY CONCENTRATION (mg/kg)
- ND NOT DETECTED

NOT TO SCALE

FIGURE 3 - CROSS SECTION - SAMPLE LINE E  
PYRIDIUM MERCURY DISPOSAL SITE No. 1  
HARRIMAN, NEW YORK  
DECEMBER 1994

US EPA REMOVAL ACTION BRANCH  
SUPERFUND TECHNICAL ASSESSMENT AND RESPONSE TEAM  
CONTRACT # 68-W5-0019

DRW BY: J. HAMPTON JR.

EPA TASK MONITOR: E. WILSON

START PROJECT MANAGER: K. CAMPBELL



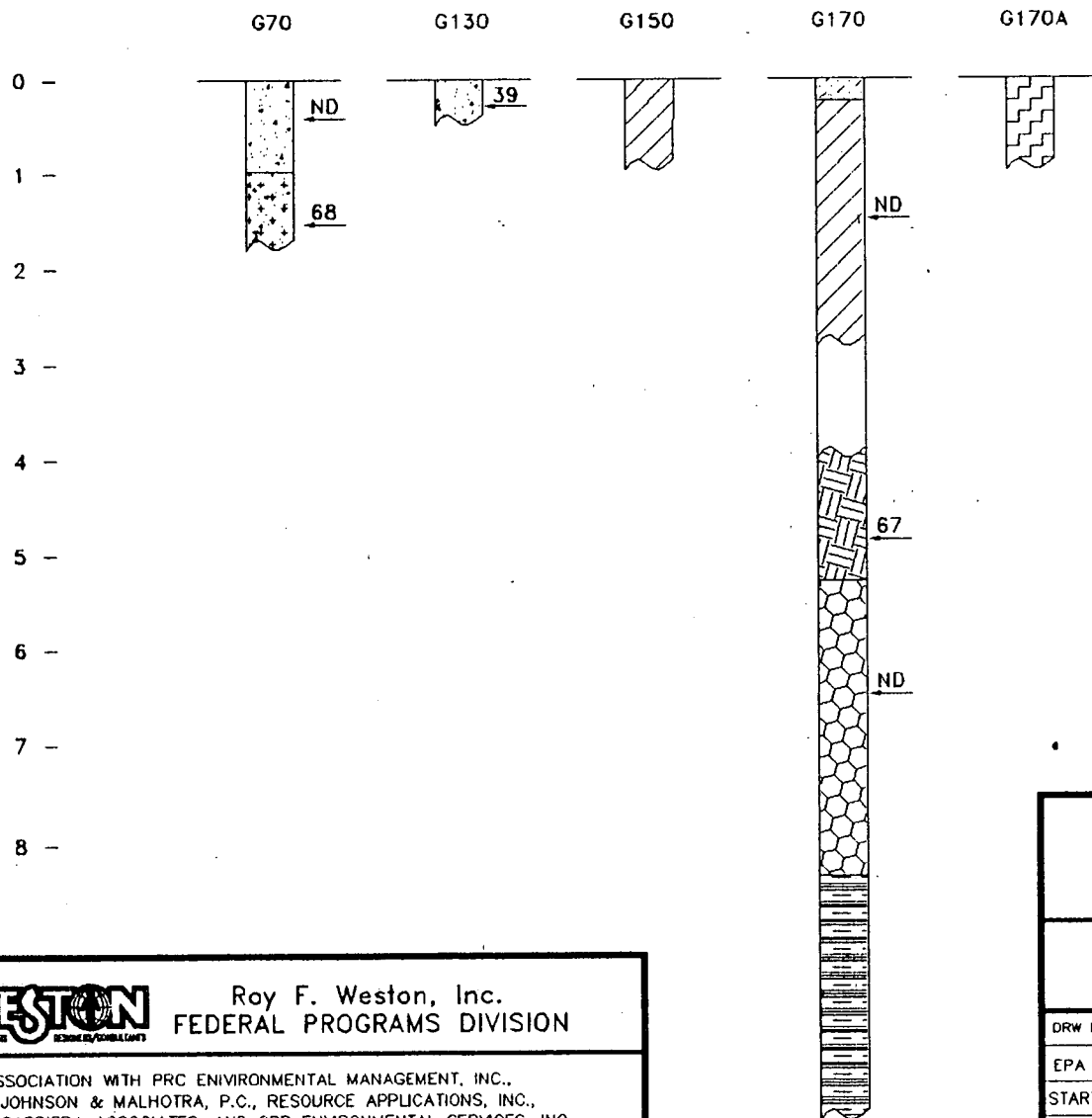
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R.E. SARRIERA ASSOCIATES, AND GRB ENVIRONMENTAL SERVICES, INC.

100179



DEPTH (ft)



LEGEND:

- GRAY SILT, COARSE SAND, AND CLAY
- PRODUCT
- YELLOW/BROWN SILT AND SAND
- LIGHT BROWN COARSE SAND AND SILT(Saturated)
- BLACK SILT AND FINE SAND
- DARK BROWN SILT AND MEDIUM TO COARSE SAND
- STRONG BROWN FINE SAND, AND SILT
- DARK BROWN ORGANIC SILT
- 68 SAMPLE LOCATION AND MERCURY CONCENTRATION(mg/kg)
- ND NOT DETECTED

NOT TO SCALE

FIGURE 4 - CROSS SECTION - SAMPLE LINE G  
PYRIDIDIUM MERCURY DISPOSAL SITE No. 1  
HARRIMAN, NEW YORK  
DECEMBER 1994

US EPA REMOVAL ACTION BRANCH  
SUPERFUND TECHNICAL ASSESSMENT AND RESPONSE TEAM  
CONTRACT# 68-W5-0019

DRW BY: J. HAMPTON JR.

EPA TASK MONITOR: E. WILSON

START PROJECT MANAGER: K. CAMPBELL



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R.E. SARRIERA ASSOCIATES, AND GRB ENVIRONMENTAL SERVICES, INC.

100180

APPENDIX H

CALCULATION OF THE QUANTITY  
OF CONTAMINATED SOIL

CLIENT/SUBJECT Tyndrum Mercury Disposal Site No. 1 W.O. NO. \_\_\_\_\_

TASK DESCRIPTION Contaminant Volume Calculation TASK NO. 100182

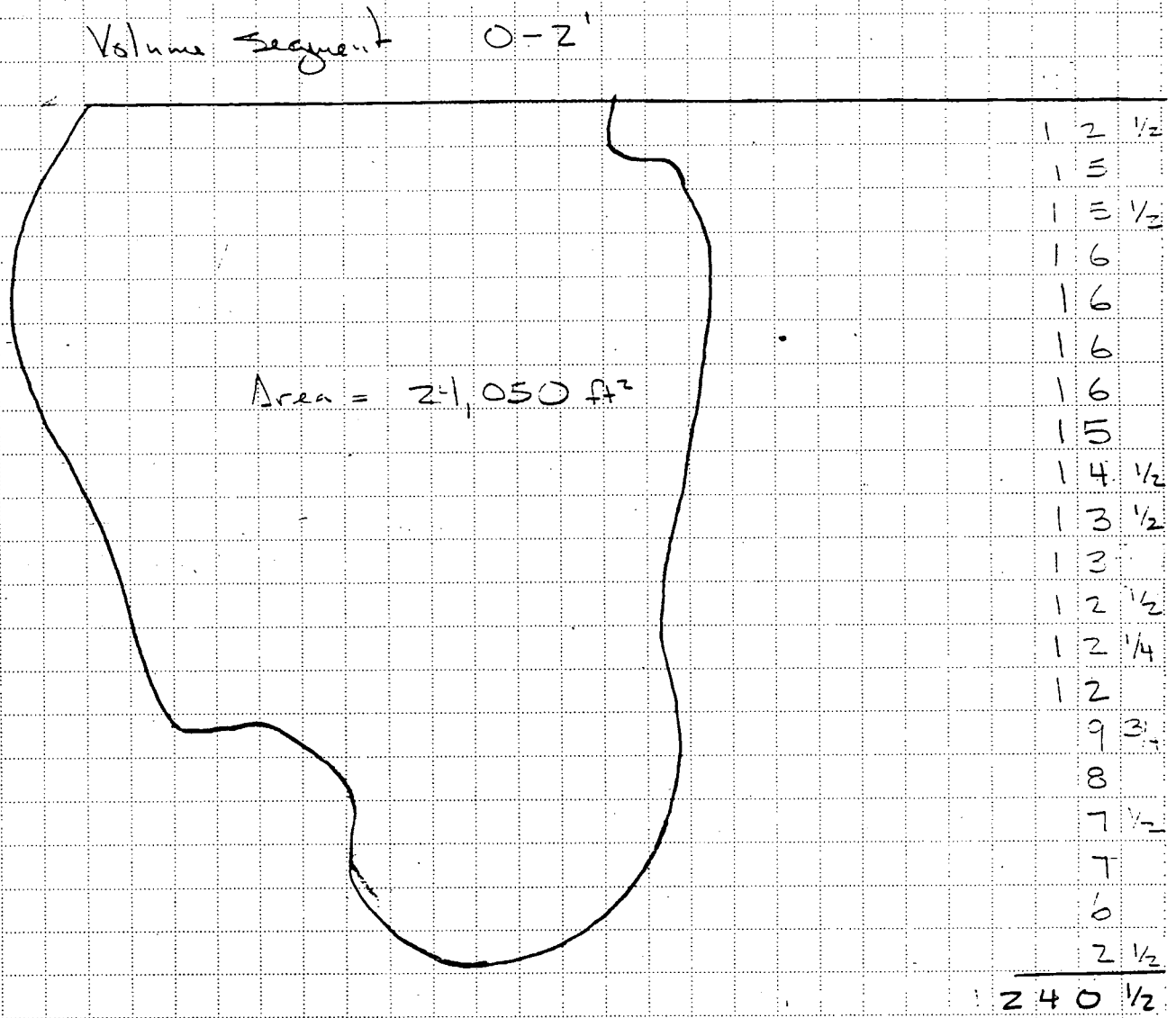
PREPARED BY Eric Wilson DEPT \_\_\_\_\_ DATE \_\_\_\_\_

MATH CHECK BY \_\_\_\_\_ DEPT \_\_\_\_\_ DATE \_\_\_\_\_

METHOD REV. BY \_\_\_\_\_ DEPT \_\_\_\_\_ DATE \_\_\_\_\_

APPROVED BY \_\_\_\_\_

DEPT \_\_\_\_\_ DATE \_\_\_\_\_



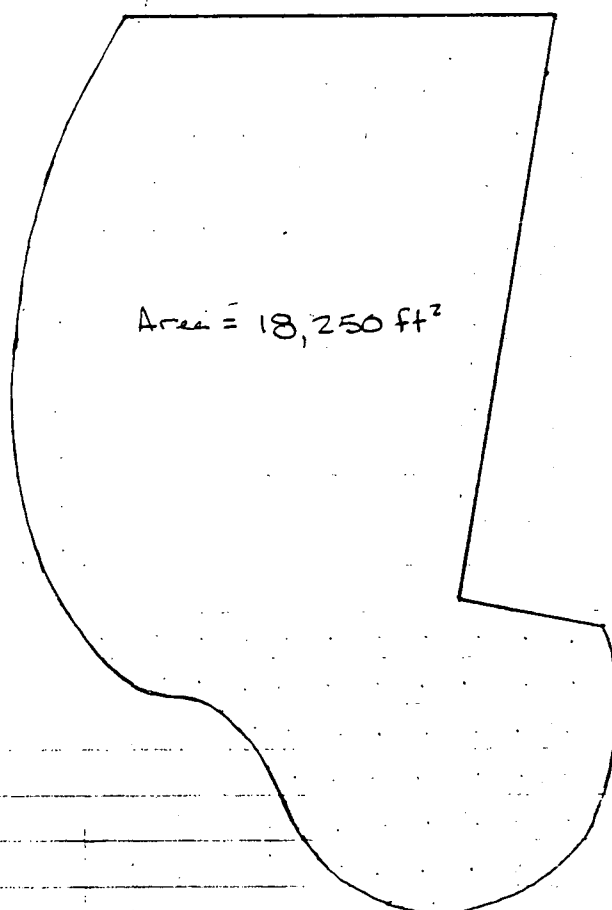
Refer to Figure 3 Scale 1" = 40'

$$240.5 \text{ squares} \left( \frac{1 \text{ scale inch}}{16 \text{ squares}} \right)^2 \left( \frac{40 \text{ feet}}{1 \text{ scale inch}} \right)^2 = 24,050 \text{ ft}^2$$

$$\text{Volume} = \text{Area} (\text{depth}) = 24,050 \text{ ft}^2 (2 \text{ ft}) = 48,100 \text{ ft}^3$$

CLIENT/SUBJECT Pyridium Mercury Disposal Site No. 1 W.O. NO. \_\_\_\_\_  
 TASK DESCRIPTION Contaminant Volume Calculation TASK NO. **100183**  
 PREPARED BY \_\_\_\_\_ DEPT \_\_\_\_\_ DATE \_\_\_\_\_ APPROVED BY \_\_\_\_\_  
 MATH CHECK BY \_\_\_\_\_ DEPT \_\_\_\_\_ DATE \_\_\_\_\_  
 METHOD REV. BY \_\_\_\_\_ DEPT \_\_\_\_\_ DATE \_\_\_\_\_ DEPT \_\_\_\_\_ DATE \_\_\_\_\_

Volume Segment 2-4'



9 1/2  
 1 0  
 1 0 1/4  
 1 0 1/2  
 1 0 1/2  
 1 0 1/2  
 1 0 3/4  
 1 0 3/4  
 1 0 1/2  
 1 0 1/4  
 1 0  
 9 1/2  
 9  
 1 1  
 1 0 1/2  
 8 1/4  
 7 1/2  
 6 1/2  
 5 1/4  
 1 1/2  
 182 1/2

Refer to Figure 3 Scale 1" = 40'

$$182.5 \text{ squares} \left( \frac{1 \text{ scale inch}^2}{16 \text{ squares}} \right) \left( \frac{40 \text{ feet}}{1 \text{ scale inch}} \right)^2 = 18,250 \text{ ft}^2$$

$$\text{Volume} = \text{Area (depth)} = 18,250 \text{ ft}^2 (-2 \text{ ft}) = 36,500 \text{ ft}^3$$

CLIENT/SUBJECT Pyridium Mercury Disposal Site No. 1

W.O. NO. \_\_\_\_\_

TASK DESCRIPTION Contaminant Volume Calculation

TASK NO. 100184

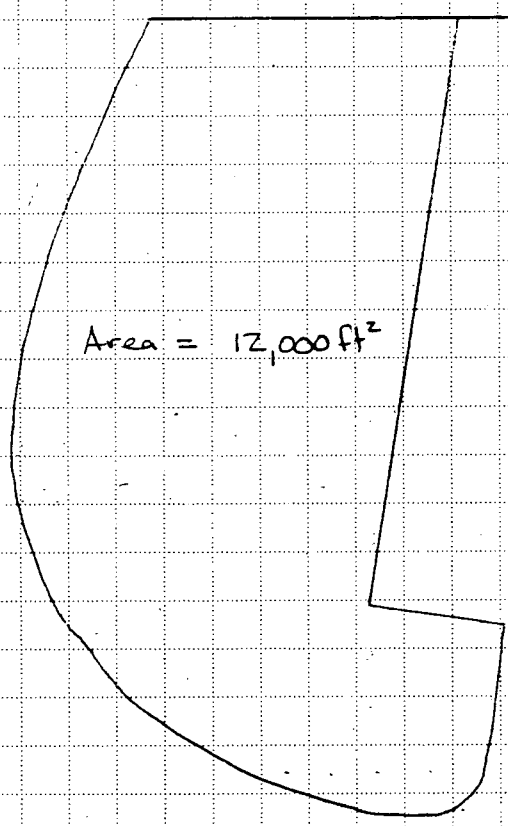
PREPARED BY \_\_\_\_\_ DEPT \_\_\_\_\_ DATE \_\_\_\_\_

MATH CHECK BY \_\_\_\_\_ DEPT \_\_\_\_\_ DATE \_\_\_\_\_

METHOD REV. BY \_\_\_\_\_ DEPT \_\_\_\_\_ DATE \_\_\_\_\_

APPROVED BY	
DEPT _____	DATE _____

Volume Segment 4-6'



- 5
- 6 3/4
- 7
- 7 1/4
- 7 1/2
- 7 3/4
- 8
- 8
- 8
- 8
- 7 3/4
- 7 1/2
- 7
- 8 1/4
- 8 1/4
- 7
- 4 3/4
- 1 1/4

120

Refer to Figure 3 Scale 1" = 40'

$$120 \text{ Squares} \left( \frac{100 \text{ ft}^2}{\text{Square}} \right) = 12,000 \text{ ft}^2$$

$$\text{Volume} = \text{Area} (\text{depth}) = 12,000 \text{ ft}^2 (2 \text{ ft}) = 24,000 \text{ ft}^3$$

CLIENT/SUBJECT Pyridium Mercury Disposal Site No. 1 W.O. NO. \_\_\_\_\_

TASK DESCRIPTION Contaminant Volume Calculation TASK NO. 100185

PREPARED BY _____	DEPT _____	DATE _____	<table border="1"> <tr><td align="center" colspan="2">APPROVED BY</td></tr> <tr><td> </td><td> </td></tr> <tr> <td>DEPT _____</td> <td>DATE _____</td> </tr> </table>	APPROVED BY				DEPT _____	DATE _____
APPROVED BY									
DEPT _____	DATE _____								
MATH CHECK BY _____	DEPT _____	DATE _____							
METHOD REV. BY _____	DEPT _____	DATE _____							

Volume of Contaminants =  $\Sigma$  Volume Segments

depth (ft)	Volume (ft <sup>3</sup> )
------------	---------------------------

0-2'	48,100
2-4'	36,500
4-6'	<u>24,000</u>

$\Sigma V$  = 108,600

= 108,600 ft<sup>3</sup>  $\left( \frac{1 \text{ yd}^3}{27 \text{ ft}^3} \right) = 4022 \text{ y}$

APPENDIX I

NIST CERTIFICATE OF ANALYSIS  
FOR STANDARD REFERENCE MATERIAL 2709

## National Institute of Standards &amp; Technology

## Certificate of Analysis

## Standard Reference Material 2709

San Joaquin Soil

## Baseline Trace Element Concentrations

This Standard Reference Material (SRM) is intended primarily for use in the analysis of soils, sediments, or other materials of a similar matrix. SRM 2709 is an agricultural soil that was oven-dried, sieved, and blended to achieve a high degree of homogeneity. A unit of SRM 2709 consists of 50 g of the dried material.

The certified elements for SRM 2709 are given in Table 1. The values are based on measurements using one definitive method or two or more independent and reliable analytical methods. Noncertified values for a number of elements are given in Table 2 as additional information on the composition. The noncertified values should not be used for calibration or quality control. Analytical methods used for the characterization of this SRM are given in Table 3 along with analysts and cooperating laboratories. All values (except for carbon) are based on measurements using a sample weight of at least 250 mg. Carbon measurements are based on 100-mg samples.

## NOTICE AND WARNINGS TO USERS

Expiration of Certification: This certification is valid for 5 years from the date of shipment from NIST. Should any of the certified values change before the expiration of the certification, purchasers will be notified by NIST. Return of the attached registration card will facilitate notification.

Stability: This material is considered to be stable; however, its stability has not been rigorously assessed. NIST will monitor this material and will report any substantive changes in certification to the purchaser.

Use: A minimum sample weight of 250 mg (dry weight - see Instructions for Drying) should be used for analytical determinations to be related to the certified values on this Certificate of Analysis.

To obtain the certified values, sample preparation procedures should be designed to effect complete dissolution. If volatile elements (i.e., Hg, As, Se) are to be determined, precautions should be taken in the dissolution of SRM 2709 to avoid volatilization losses.

Statistical consultation was provided by S.B. Schiller of the NIST Statistical Engineering Division.

The overall direction and coordination of the analyses were under the chairmanship of M.S. Epstein and R.L. Watters, Jr., of the NIST Inorganic Analytical Research Division.

The technical and support aspects involved in the preparation, certification, and issuance of this Standard Reference Material were coordinated through the Standard Reference Materials Program by T.E. Gills and J.S. Kane.

Gaithersburg, MD 20899  
October 30, 1992

William P. Reed, Chief  
Standard Reference Materials Program

(over)



Instructions for Drying: When nonvolatile elements are to be determined, samples should be dried for 2 h at 110 °C. Volatile elements (i.e., Hg, As, Se) should be determined on samples as received; separate samples should be dried as previously described to obtain a correction factor for moisture. Correction for moisture is to be made to the data for volatile elements before comparing to the certified values. This procedure ensures that these elements are not lost during drying. The weight loss on drying has been found to be in the range of 1.8 to 2.5 %.

Source and Preparation of Material: The U.S. Geological Survey (USGS), under contract to the NIST, collected and processed the material for SRM 2709. The soil was collected from a plowed field, in the central California San Joaquin Valley, at Longitude 121° 25' and Latitude 36° 55'. The collection site is in the Panoche fan between the Panoche and Cantu creek beds. The top 7.5-13 cm (3-5 in) of soil containing sticks and plant debris was removed, and the soil was collected from the 13 cm level down to a depth of 46 cm (18 in) below the original surface. The material was shoveled into 0.114 m<sup>3</sup> (30-gal) plastic buckets and shipped to the USGS laboratory for processing.

The material was spread on 30.5 cm x 61 cm (1 ft x 2 ft) polyethylene-lined drying trays in an air drying oven and dried for three days at room temperature. The material was then passed over a vibrating 2-mm screen to remove plant material, rocks, and large chunks of aggregated soil. Material remaining on the screen was deaggregated and rescreened. The combined material passing the screen was ground in a ball mill to pass a 74- $\mu$ m screen and blended for 24 h. Twenty grab samples were taken and measured for the major oxides using x-ray fluorescence spectrometry and for several trace elements using inductively coupled plasma atomic emission analysis to provide preliminary assessment of the homogeneity of the material prior to bottling. The material was bottled into 50-g units and randomly selected bottles were taken for the final homogeneity testing.

Analysis: The homogeneity, using selected elements in the bottled material as indicators, was assessed using x-ray fluorescence spectrometry and neutron activation analysis. In a few cases, statistically significant differences were observed, and the variance due to material inhomogeneity is included in the overall uncertainties of the certified values. The estimated relative standard deviation for material inhomogeneity is less than 1 % for those elements for which homogeneity was assessed.

Certified Values and Uncertainties: The certified values are weighted means of results from two or more independent analytical methods, or the mean of results from a single definitive method, except for mercury. Mercury certification is based on cold vapor atomic absorption spectrometry used by two different laboratories employing different methods of sample preparation prior to measurement. The weights for the weighted means were computed according to the iterative procedure of Paule and Mandel (NBS Journal of Research 87, 1982, pp. 377-385). The stated uncertainty includes allowances for measurement imprecision, material variability, and differences among analytical methods. Each uncertainty is the sum of the half-width of a 95 % prediction interval and includes an allowance for systematic error among the methods used. In the absence of systematic error, a 95 % prediction interval predicts where the true concentrations of 95 % of the samples of this SRM lie.

Table 1. Certified Values

<u>Element</u>	<u>wt. %</u>		<u>Element</u>	<u>µg/g</u>	
Aluminum	7.50	= 0.06	Antimony	7.9	= 0.6
Calcium	1.89	= 0.05	Arsenic	17.7	= 0.8
Iron	3.50	= 0.11	Barium	968	= 40
Magnesium	1.51	= 0.05	Cadmium	0.38	= 0.01
Phosphorus	0.062	= 0.005	Chromium	130	= 4
Potassium	2.03	= 0.06	Cobalt	13.4	= 0.7
Silicon	29.66	= 0.23	Copper	34.6	= 0.7
Sodium	1.16	= 0.03	Lead	18.9	= 0.5
Sulfur	0.089	= 0.002	Manganese	538	= 17
Titanium	0.342	= 0.024	Mercury	1.40	= 0.08
			Nickel	88	= 5
			Selenium	1.57	= 0.08
			Silver	0.41	= 0.03
			Strontium	231	= 2
			Thallium	0.74	= 0.05
			Vanadium	112	= 5
			Zinc	106	= 3

Noncertified Values: Noncertified values, shown in parentheses, are provided for information only. An element concentration value may not be certified if a bias is suspected in one or more of the methods used for certification, or if two independent methods are not available. Certified values for some of these elements will eventually be provided in a revised certificate when more data is available.

Table 2. Noncertified Values

<u>Element</u>	<u>wt. %</u>	<u>Element</u>	<u>µg/g</u>
Carbon	(1.2)	Cerium	(42)
		Cesium	(5.3)
		Dysprosium	(3.5)
		Europium	(0.9)
		Gallium	(14)
		Gold	(0.3)
		Hafnium	(3.7)
		Holmium	(0.54)
		Iodine	(5)
		Lanthanum	(23)
		Molybdenum	(2.0)
		Neodymium	(19)
		Rubidium	(96)
		Samarium	(3.8)
		Scandium	(12)
		Thorium	(11)
		Tungsten	(2)
		Uranium	(3)
		Ytterbium	(1.6)
		Yttrium	(18)
		Zirconium	(160)

Table 3. Analytical Methods Used for the Analysis of SRM 2709

100190

Element	Certification Methods	Element	Certification Methods
Ag	ID ICPMS; RNAA	Mo	ID ICPMS
Al	XRF1; XRF2; INAA; DCP; ICP	Na	INAA; FAES; ICP
As	RNAA; HYD AAS; INAA	Nd	ICP
Au	INAA; FAAS	Ni	ID ICPMS; ETAAS; INAA
Ba	XRF2; FAES	P	DCP; COLOR; XRF2
C	COUL	Pb	ID TMS
Ca	XRF1; XRF2; DCP	Rb	INAA
Cd	ID ICPMS; RNAA	S	ID TMS
Ce	INAA; ICP	Sb	INAA; ETAAS
Co	INAA; ETAAS; ICP	Sc	INAA; ICP
Cr	INAA; DCP; ICP	Se	RNAA; HYD AAS
Cs	INAA	Si	XRF1; XRF2; GRAV
Cu	RNAA; FAES; ICP	Sm	INAA
Dy	INAA	Sr	ID TMS; INAA; ICP
Eu	INAA	Th	ID TMS; INAA; ICP
Fe	XRF1; XRF2; INAA; DCP	Ti	INAA; XRF1; XRF2; DCP
Ga	INAA; ICP	Tl	ID TMS; LEAFS
Hf	INAA	U	ID TMS; INAA
Hg	CVAAS	V	INAA; ICP
Ho	INAA	W	INAA
I	INAA	Y	ICP
K	XRF1; XRF2; FAES; ICP; INAA	Yb	INAA
La	INAA; ICP	Zn	ID TMS; ICP; INAA; POLAR
Mg	INAA; XRF1; ICP	Zr	INAA
Mn	INAA; ICP		

\*Methods in bold were used to corroborate certification methods or to provide information values.

ID TMS - Isotope dilution thermal ionization mass spectrometry; mixed acid digestion.

ID ICPMS - Isotope dilution inductively coupled plasma mass spectrometry; mixed acid digestion.

INAA - Instrumental neutron activation analysis.

RNAA - Radiochemical neutron activation analysis; mixed acid digestion.

XRF1 - Wavelength dispersive x-ray fluorescence on fused borate discs.

XRF2 - Wavelength dispersive x-ray fluorescence spectrometry on pressed powder.

ICP - Inductively coupled plasma atomic emission spectrometry; mixed acid digestion.

DCP - Direct current plasma atomic emission spectrometry; lithium metaborate fusion.

ETAAS - Electrothermal atomic absorption spectrometry; mixed acid digestion.

CVAAS - Cold vapor atomic absorption spectrometry.

HYD AAS - Hydride generation atomic absorption spectrometry.

FAAS - Flame atomic absorption spectrometry; mixed acid digestion except for Au, leached with HBr-Br<sub>2</sub>.

FAES - Flame atomic emission spectrometry; mixed acid digestion.

COLOR - Colorimetry; lithium metaborate fusion.

GRAV - Gravimetry; sodium carbonate fusion.

COUL - Combustion coulometry.

LEAFS - Laser enhanced atomic fluorescence spectrometry; mixed acid digestion.

POLAR - Polarography.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY - REGION II

290 BROADWAY

NEW YORK, NEW YORK 10007-1866

200001

ACTION MEMORANDUM

DATE:

FEB 27 1996

SUBJECT: Documentation of Verbal Authorization for a Removal Action at Pyridium Mercury Disposal Site No. 1, Village of Harriman, Orange County, New York

FROM:

*James D. Harkay*  
James D. Harkay, On-Scene Coordinator  
Removal Action Branch Section B

TO:

Kathleen C. Callahan, Director  
Emergency and Remedial Response Division

THRU:

*Richard C. Salkie*  
Richard C. Salkie, Associate Director  
Removal and Emergency Preparedness Programs

Site No.: EV

I. PURPOSE

The purpose of this Action Memorandum is to document the verbal authorization received to conduct a removal action at the Pyridium Mercury Disposal Site No. 1 (Site). The Site is located on Route 17M within the Village of Harriman, Orange County, New York, 10926.

The Site consists of a residential/commercial property which was backfilled with mercury contaminated industrial waste. Five mobile home trailers inhabited the Site. This document details the rationale used to conduct the removal activities implemented at the Site and discusses how the Site met the criteria for a removal action under Section 300.415(b)(2) of the National Contingency Plan (NCP).

On January 4, 1995, the U.S. Environmental Protection Agency (EPA) Emergency and Remedial Response Division (ERRD) Director granted verbal authorization to conduct a removal action at the Site to decontaminate or dispose of the five mobile home trailers. The funding approval to address the mobile home trailers was \$100,000, of which \$75,000 was for mitigation contracting.

The Site is not on the National Priorities List (NPL) and there were no nationally significant precedent-setting issues associated with the removal action.

## II. SITE CONDITIONS AND BACKGROUND

The Comprehensive Environmental Response, Compensation, and Liability Information System ID Number for this time-critical removal action is NY0000856237.

### A. Site Description

#### 1. Removal site evaluation

On August 8, 1994, responding to a complaint, representatives from the New York State Department of Health (NYSDOH) and the New York State Department of Environmental Conservation (NYSDEC) discovered a white clay-like waste material during their investigation. Samples of the waste material were collected and submitted for laboratory analyses. The analyses indicated elevated concentrations of mercury ( $\leq 657$  mg/kg). A concentration of mercury typically found in soils within this geographic area is  $\leq 1$  mg/kg. Mercury is a designated Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) hazardous substance and is listed in 40 CFR Table 302.4.

In a correspondence dated September 9, 1994, the NYSDOH outlined site conditions and requested the NYSDEC to seek assistance from the EPA to address the threats to public health, welfare and the environment. On September 29, 1994, the Site was formally referred to the EPA for a CERCLA removal action consideration via correspondence from the NYSDEC (Appendix A).

From October 13-15, 1994, the EPA and their Technical Assistance Team (TAT) contractor conducted a removal site evaluation that included verification of mercury contamination as well as delineating lateral extent of contamination in surface soils. A total of 54 surface soil samples were analyzed using a Spectrace Model 9000 X-Ray Fluorescence Analyzer (XRF). Results from the XRF indicated widespread (i.e.,  $\approx 15,000$  square feet) mercury contamination of the surface soils within the trailer park.

On October 20, 1994, one composite waste sample was collected for waste characterization and mercury speciation. For waste characterization, the sample was analyzed for Target Compound List (TCL) parameters, Target Analyte List (TAL) parameters, and toxicity via the Toxicity Characteristic Leachate Procedure (TCLP). Analytical results for TAL parameters indicated elevated concentrations of mercury and calcium. TCL compounds detected in the composite sample included: methylene chloride, pyrene, phenanthrene, fluoranthene, benzo(k)fluoranthene, benzo(b)fluoranthene, benzo(a)anthracene, chrysene and

benzo(a)pyrene. However, these volatile and semi-volatile organic compound concentrations were below NYSDEC-recommended soil cleanup objectives and the TCLP results were below regulatory levels. Mercury speciation results indicated that the sample was a chemical substrate contaminated with a mercuric or mercurous salt and was not elemental mercury.

On November 17, 1994, the EPA's Environmental Response Team (ERT) and EPA's Response Engineering and Analytical Contractor (REAC) collected dust samples from each of the five mobile homes. Analytical results of the sampling event indicated mercury concentrations ranging from 0.84 mg/kg to 26.8 mg/kg. The highest concentration was detected within the entrance area into mobile home No. 3.

On December 6, 1994, the ERT, REAC and the TAT contractor collected soil samples from borings to determine the vertical extent of contamination. Soil samples were screened using an XRF for the presence of mercury. Based upon the XRF data, it is estimated that 3,600 cubic yards of waste and contaminated soil exists on the Site.

## **2. Physical location**

Pyridium No. 1 is located in a mixed residential/commercial area at the intersection of Route 17M and Harriman Heights Road (Appendix B, Figure 1). The Site's property (Block No. 5: Lot No. 2) is bordered on the northwest by an auto transmission shop, on the northeast by Route 17M, on the southeast by wetlands and on the southwest by a residential lawn (Appendix B, Figure 2). (The wetlands are not formally designated as such on the corresponding U.S. Department of the Interior National Wetland Inventory Map). Approximately 16 people resided in the five mobile homes which varied in size from 400 to 900 square feet. An elementary school is located approximately 1,000 feet north of the Site.

## **3. Site characteristics**

The Site occupies approximately one acre out of the property's total area of 1.93 acres. On-site contamination is reportedly from the disposal of mercury contaminated industrial waste generated by the Pyridium Corporation. Disposal of the waste occurred during the 1940's when the material was used as backfill in low-lying areas on the property.

This Action Memorandum addresses a removal action restart. See Section II.B for a discussion of the previous removal action.

4. Release or threatened release into the environment of a hazardous substance, or pollutant, or contaminant

Mercury, a designated CERCLA hazardous substance as defined by Section 101(14) is present on the Site. The mercury contaminated waste is visible in surface soils and has been identified in subsurface soils. Site investigations indicated approximately 3,600 cubic yards of waste was disposed of on the Site. The waste is unconfined and has migrated off-site into an adjacent wetlands from storm water drainage. Since the waste is present in surface soils, the potential exists for the hazardous substance to be tracked off-site by humans and animals visiting the Site.

5. NPL status

The Site is not listed on the NPL. A Preliminary Assessment (PA) may be conducted to determine the need for a Site Inspection (SI) for possible NPL listing. The Site has been evaluated by the Agency for Toxic Substance and Disease Registry (ATSDR). The health consultation is included in Appendix C.

6. Maps, pictures and other graphic representations

Figures 1 and 2 which are included in Appendix B, illustrate the location and configuration of the Site.

B. Other Actions to Date

1. Previous actions

On October 12, 1994, a public meeting was held in the Village of Harriman to discuss the Site situation and to address community concerns. The meeting was attended by representatives of the Village of Harriman, Orange County Department of Health, NYSDOH, NYSDEC, ATSDR and EPA. On November 28, 1994, a public availability session was held in the Village of Harriman. The session was attended by representatives of NYSDOH, ATSDR and EPA. Analytical results of the October 13-20, 1994 sampling events were made available to the public during this meeting.

On November 28, 1994, Nepera, Inc., signed an Administrative Order on Consent (AOC) with EPA agreeing to fund the relocation of the trailer park residents. Nepera, Inc. has distributed relocation settlements to the eligible residents according to federal relocation guidelines.

In January 1995, a Final Health Consultation Report was prepared by the NYSDOH under a cooperative agreement with the ATSDR (Appendix C). The report states that the Pyridium Site is a public health hazard due to elevated mercury concentrations in

soils. On-site residents are suspected to be at risk of kidney damage through mercury ingestion/inhalation.

## **2. Current actions**

The purpose of this action was to secure and stabilize the Site. On January 9, 1995, the EPA Emergency Response Cleanup Service (ERCS) contractor and the TAT contractor mobilized and initiated the removal action. After the mobile homes were vacated, they were decontaminated, sampled and relinquished to their owner for resale. However, due to the condition of the mobile homes, only two were able to be sold. The remaining three were dismantled on-site and discarded as debris. Prior to being sold, interiors of the two mobile homes were decontaminated. Decontamination was accomplished by cleaning all hard surfaces, dusting all air-conditioning and heating ducts and removing all porous materials (e.g., carpets, curtains, furniture, etc...). Following decontamination, interior dust samples were collected to verify attainment of acceptable interior cleanup levels. All utilities (water, sewer, electric) were disconnected and all heating oil and propane storage tanks were removed for disposal/recycle. Warning signs were clearly posted to inform the public of the conditions on the Site.

The mitigation contracting cost to complete this removal action was approximately \$51,000.

## **C. State and Local Authorities' Role**

### **1. State and local actions to date**

In August 1994, the NYSDEC and the NYSDOH conducted preliminary investigations at the Site. These investigations involved the collection of soil samples from visibly contaminated areas, sampling indoor and outdoor air, utilizing a mercury vapor analyzer and meeting with the affected residents to discuss public health concerns. During the month of October 1994, the NYSDOH conducted urine mercury screening of the mobile home residents. A total of 14 individuals participated in the testing program. All 14 individuals had urine mercury levels within the normal range of <20 micrograms per liter. Both State agencies provided health education services to the affected residents during the EPA removal activities.

### **2. Potential for continued State/local response**

State and local government agencies were not able to undertake timely and costly response actions to eliminate the threats posed by the Site. However, the NYSDOH offered health education services to the affected residents. The NYSDOH will investigate similar sites in the community as they are identified.



### III. THREATS TO PUBLIC HEALTH OR WELFARE OR THE ENVIRONMENT, AND STATUTORY AND REGULATORY AUTHORITIES

This Site met the criteria for a removal action under CERCLA as described in Section 300.415(b)(2) of the NCP. The Site posed a health threat to local residents and animals that could come in direct contact with the hazardous substances at the Site. High concentrations of the hazardous substance on ground surfaces have migrated and contaminated a larger area through surface water run-off and anthropogenic redistribution.

#### A. Threats to Public Health or Welfare

The presence of elevated concentrations of a designated CERCLA hazardous substance was documented in surface and subsurface soils. Analytical results of 11 surface soil samples analyzed by Cold Vapor Atomic Absorption indicated the presence of mercury at concentrations ranging from 3.74 mg/kg to 657 mg/kg. Laboratory analysis of dust samples collected from the mobile home interiors identified mercury concentrations that ranged from 0.84 mg/kg to 26.8 mg/kg. Toxicological data regarding mercury exposure documented the risk of potential kidney and neurological system damage.

Former residents of the trailer park have reportedly been exposed to mercury contamination via dermal contact. A Final NYSDOH/ATSDR Health Consultation Report noted that a resident reported, in an interview, that her children used to play with the clay-like waste material as if it were modelling clay. According to the report, 16 people resided within the mobile home park.

#### B. Threats to the Environment

Data indicates that a potential exists for contaminant migration via overland storm drainage routes. Mercury surface soil contamination was documented on site at concentrations ranging from 3.74 mg/kg to 657 mg/kg. Low level mercury contamination (13.7 mg/kg, 15.9 mg/kg, 38.9 mg/kg) was also documented in a wetland area located east of the waste disposal area. Although no visible waste material was observed at the wetland area, sampling results indicate that contaminants have migrated from the waste disposal area.

A sediment sample was also collected at the outfall of a drainage culvert located northeast of the Site, across from Route 17M. Analytical results of the sediment sample indicated the presence of mercury at a concentration of 0.643 mg/kg. Therefore, the possibility of off-site migration of mercury contamination via this overland storm drainage route exists.

#### IV. ENDANGERMENT DETERMINATION

Actual or threatened release of a hazardous substance from this Site, if not addressed by implementing the response action selected in this Action Memorandum, may have presented an imminent and substantial endangerment to public health, or welfare, or the environment.

#### V. PROPOSED ACTIONS AND ESTIMATED COSTS

##### A. Proposed Actions

##### 1. Proposed action description

The purpose of this Action Memorandum is to document actions taken by the EPA at the Site under the January 4, 1995 verbal authorization by the Director of the ERRD. The removal action effectively decontaminated two mobile homes qualified for resale and dismantled and disposed of the three mobile homes unfit for resale. The removal action under this Action Memorandum has been completed at a cost of \$51,000 for mitigation contracting.

Additional actions such as excavation and disposal of mercury contaminated soil and restoration of properties to pre-existing conditions are necessary to mitigate the threats to the public health, or welfare, or the environment. These actions will be undertaken under a separate removal action.

##### 2. Contribution to remedial performance

The actions presented in this document were consistent with any long term cleanup at the Site and were interim measures necessary to mitigate the immediate threats associated with the hazardous substance on the Site.

##### 3. Description of alternative technologies

The decontamination and removal/disposal of the mobile homes was the only technology considered because this was the most cost effective and environmentally sound method.

##### 4. EE/CA

Due to the time-critical nature of this removal action, an Engineering Evaluation/Cost Analysis (EE/CA) was not prepared.

##### 5. Applicable or relevant and appropriate requirements (ARARs)

ARARs that are within the scope of this removal action were met to the extent practicable. The federal ARARs that were determined to be applicable for this removal action are the

Resource Conservation and Recovery Act and the Occupational Safety and Health Act.

## 6. Project schedule

The removal action was initiated on January 9, 1995 under the verbal authorization from the Director of the ERRD and was completed on March 7, 1995.

## B. Estimated Costs

A summary of the estimated costs for the completed removal action is presented below.

### Extramural Costs:

Total Cleanup Contractor Costs	\$51,000
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### Other Extramural Costs not Funded from the Regional Allowance:

Total TAT	\$11,000
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<b>TOTAL, EXTRAMURAL COSTS</b>	<b>\$62,000</b>
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### Intramural Costs:

<b>TOTAL, INTRAMURAL COSTS</b>	<b>\$ 9,000</b>
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<b>TOTAL, REMOVAL PROJECT COST</b>	<b>\$71,000</b>
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## VI. EXPECTED CHANGE IN THE SITUATION SHOULD ACTION BE DELAYED OR NOT TAKEN

The actions outlined in this Action Memorandum were an interim measure to stabilize and secure the Site. If no action was taken or the action delayed, the vacant trailers could have attracted trespassers which would have resulted in a risk to public health through exposure to mercury contaminated soil. Furthermore, since the mobile homes would be vacated and unsecured, unauthorized persons could have entered the property and vandalized the mobile homes resulting in possible fire and explosions due to the presence of aboveground oil and gas storage tanks.

## VII. OUTSTANDING POLICY ISSUE

None.

# VIII. ENFORCEMENT

Site related enforcement activities were initially limited to time constraints resulting from the time-critical determination for the removal action.

In October 1994, the EPA/TAT contractor conducted a title and deed search of the property. Property owner information was obtained from 1894 to the present and is being kept on file.

The on-site waste was reportedly generated during the 1940's by the Pyridium Corporation. Nepera, Inc., currently owns and operates the facility previously operated by Pyridium Corporation. On November 28, 1994, Nepera, Inc., signed an AOC with EPA agreeing to fund the relocation of the residents of the trailer park. Nepera has distributed relocation settlements to the eligible residents.

# IX. RECOMMENDATION

This decision document represents the selected removal action for the Pyridium Mercury Disposal Site No. 1 in the Village of Harriman, Orange County, New York, developed in accordance with CERCLA, as amended, and not inconsistent with the NCP. This decision is based on the administrative record for the Site.

Conditions at the Site met the NCP Section 300.415(b)(2) criteria for the completed removal action. The total project ceiling cost for this removal action was \$71,000, of which an estimated \$51,000 came from the Regional removal allowance.

Please confirm the January 4, 1995 verbal authorization of funding for this Site, as per current Delegation of Authority, by signing below.

APPROVAL: 

DATE: 2/27/95

Kathleen C. Callahan, Director  
Emergency and Remedial Response Division

DISAPPROVAL: \_\_\_\_\_

DATE: \_\_\_\_\_

Kathleen C. Callahan, Director  
Emergency and Remedial Response Division

cc: (after approval is obtained)

J. Fox, RA  
R. Salkie, ERRD-ADREPP  
W. McCabe, ERRD-DDNYC/P  
G. Zachos, ERRD-RAB  
J. Rotola, ERRD-RAB  
M. Randol, EPD  
E. Schaaf, ORC-NYCSUP  
V. Capon, ORC-NYCSUP

R. Gherardi, OPM-FIN  
S. Murphy, OPM-FAM  
D. Dietrich, 5202G  
T. Eby, 5202G  
C. Moyik, ERRD-PS  
M. O'Toole, NYSDEC  
T. Vickerson, NYSDEC  
C. Kelly, TATL

APPENDIX A

Post-Net Fax Note 7871		Date 9/	Page 4
To Richard Saiter	From AL Rockmore		
Co./Dept. EPA	Co. NY DEC		
Phone (908) 321-6658	Phone (518) 457-9890		
Fax (908) 906-6182	Fax (518) 457-7743		

New York State Department of  
50 Wolf Road, Albany, New York, 122

SEP 29 1994

Langdon Marsh  
Commissioner

Ms. Kathleen C. Callahan  
Director  
Emergency & Remedial Response Division  
United States Environmental  
Protection Agency  
Region II  
26 Federal Plaza  
New York, New York 10278

Dear Ms. Callahan:

Re: Pyridium Mercury Disposal Site  
Harriman (V) Orange County, N.Y.

I have enclosed a copy of a letter from the New York State Department of Health, dated September 9, 1994, regarding confirmed mercury contamination in the soil beneath five trailer homes at the referenced location in the Village of Harriman, Orange County, New York.

The trailer park is located near Nepera, Inc., Harriman, which is listed in the Registry of Inactive Hazardous Waste Disposal Sites in New York State as Site Code #3-36-006. We are presently trying to determine if the mercury contamination is related to the Nepera Site.

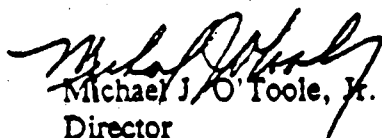
However, in the meantime, we hereby request that the USEPA conduct an Emergency Removal Assessment at the referenced location and initiate whatever response action is warranted by the findings of such an assessment and are authorized by CERCLA/SARA.

Ms. Kathleen C. Callahan

Page 2

If you have any questions regarding this request, please contact Alan Rockmore, P.E., of my staff, at (518) 457-9180.

Sincerely,



Michael J. O'Toole, Jr.  
Director  
Div. of Hazardous Waste Remediation

Enclosure

cc: A. Carlson, NYSDOH  
R. Salkie - USEPA, Edison, New Jersey  
G. Zachos - USEPA, Edison, New Jersey  
J. Witkowski - USEPA, Edison, New Jersey



# STATE OF NEW YORK DEPARTMENT OF HEALTH

Center for Environmental Health

2 University Place

Albany, New York 12203-3399

Mark R. Chassin, M.D., M.P.H., M.P.M.  
Commissioner

Paul Wilson  
Executive Deputy Commissioner

OFFICE OF PUBLIC HEALTH

Lloyd F. Novack, M.D., M.P.H.  
Director

Diane Jones Ritter  
Executive Deputy Director

William N. Stasul, P.E., Ph.D.  
Center Director

September 9, 1994

Mr. Michael J. O Toole, P.E., Director  
Division of Hazardous Waste Remediation  
NYS Department of Environmental Conservation  
50 Wolf Road, Room 212  
Albany, New York 12273

RE: Mitigating Potential Exposures  
Pyridium Mercury Disposal Site  
NYSDOH Site #336821N  
IV) Harriman, Orange County

Dear Mr. O Toole:

As you know, both our agencies recently learned that five residential trailer homes sit over chemical wastes near the corner of Routes 17M and 71 in the Village of Harriman, Orange County. Within the five trailers live twelve residents including an expectant mother and her four year old son. The waste materials, suspected to be calcium sulfate and mercuric sulfide generated by the former Pyridium Corporation (presently Nepera, Inc.), were allegedly dumped during the late 1940's. Testing by the State has revealed significantly elevated levels of mercury in the surface soils and surface wastes ranging from 110 parts per million (ppm) to 653 ppm with an average mercury concentration of 288 ppm. Mercury is typically found in soils at levels less than 1 ppm. Residents have reportedly encountered the waste materials in recurring sinkholes/subsidence on the property, within soil excavations for fence posts and sewer lines, while gardening, and during wet conditions when their parking area turns milky-white. Allegedly children, now grown, had used the clay-like material as if it was "Playdoh."

Exposure to either inorganic or organic mercury can permanently damage the brain, kidneys, and developing fetus. The most sensitive target of low-level exposure to inorganic mercury appears to be the kidneys. Exposure to mercury in the soil can occur through a number of routes. There is the potential for direct oral exposure via ingestion of soil, dust, and garden produce grown in contaminated soil. Mercury can be absorbed into the body via dermal contact through activities associated with soil disturbances such as gardening, yard work, and play. There also exists the potential for inhalation of mercury particulates and mercury vapor.

The elevated levels of mercury in soil are a public health concern. To minimize potential human exposure to these accessible chemical wastes, residents have been advised to avoid physical contact with their yard soils which contain the easily distinguishable white waste material. Vegetable gardening is not recommended. These temporary advisories should be followed by a timely permanent solution. However, Extraction Procedure Toxicity testing by the New York State Department



of Environmental Conservation's contract laboratory did not confirm the presence of "hazardous waste" as legally defined by the State. Therefore, as I understand the process, State Superfund monies cannot be spent on any site-related activities that may be needed.

Consequently, the State should seek assistance from the United States Environmental Protection Agency (EPA) to expedite this matter for the long-term welfare of the concerned residents as well as for the protection of the environment. To that end, this Department is in the process of preparing a health consultation, which will be reviewed by the federal Agency for Toxic Substances and Disease Registry (ATSDR). We expect conditions at the site to meet the ATSDR's definition of a public health hazard. We will be forwarding a health consultation as soon as possible. In the meantime, the ATSDR and the EPA have been advised of the situation.

Should you wish to discuss this issue further, do not hesitate to contact me or Mr. Steven Bates at (518) 458-6310.

Sincerely,

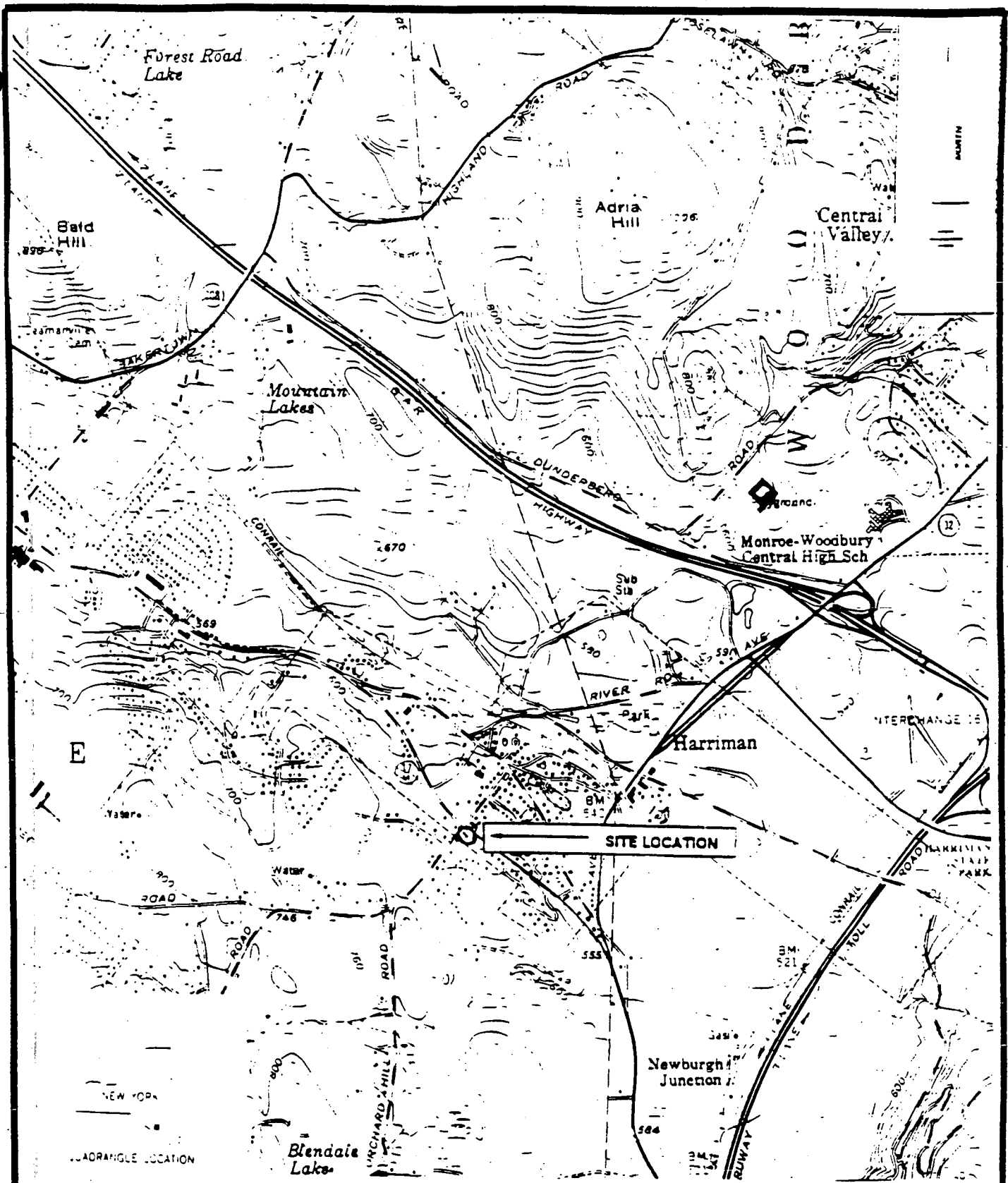


G. Anders Carlson, Ph.D.  
Director  
Bureau of Environmental Exposure  
Investigation

sg/94252PRO0019

cc: Dr. N. Kim  
Mr. R. Tramontano/Mr. R. Svenson/Mr. F. Mrozek  
Dr. E. Horn/Dr. D. Luttinger/Ms. P. Fritz  
Ms. N. Knapp  
Mr. S. Bates/Mr. M. VanValkenburg  
Mr. M. Knudsen, MDO  
Mr. M. Schleifer - OCHD  
Mr. C. Goddard - DEC  
Ms. S. McCormick/Mr. C. Magee DEC  
Mr. D. Eaton - DEC  
Mr. A. Klauss - DEC, Region 3  
Mr. A. Block/Mr. S. Jones - ATSDR  
Mr. W. McCabe - EPA, Region 2

**APPENDIX B**



Roy F. Weston, Inc.  
MAJOR PROGRAMS DIVISION

IN ASSOCIATION WITH FOSTER WHEELER CORP.,  
C.C. JOHNSON & MALHOTRA, P.C., RESOURCE  
APPLICATIONS, INC. AND R.E. SARRIERA ASSOCIATES

EPA PM

D. HARKAY

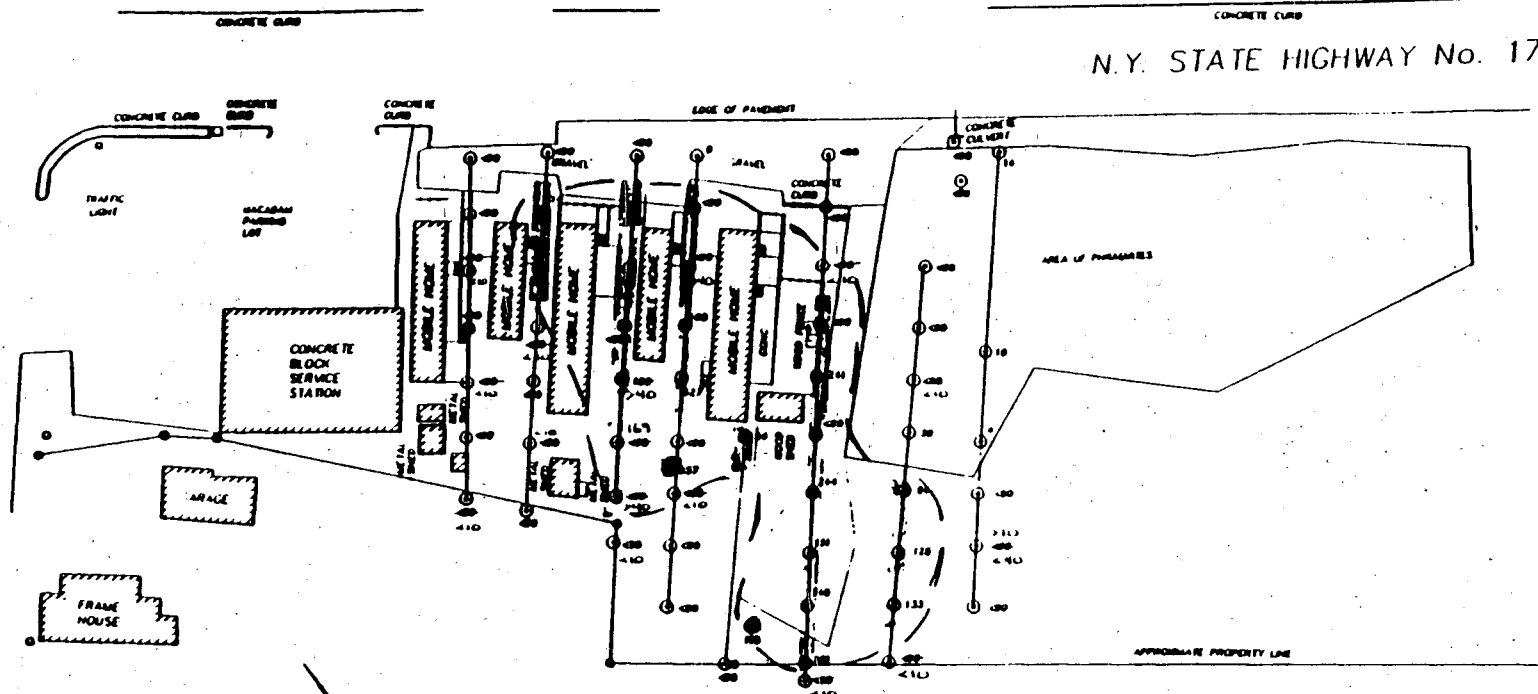
TAT PM

S. MAY

FIGURE 1  
SITE LOCATION MAP

PYRIDIUM MERCURY  
DISPOSAL SITE NO. 1

COUNTY HIGHWAY 71



**LEGEND**

- ⊙ Sample Location
- ⊞ Estimated Mercury concentration (ng/kg)
- ⊞ Mercury concentration Less Than 90ng/kg

**WESTON**

Roy F. Weston, Inc.  
MAJOR PROGRAMS DIVISION

IN ASSOCIATION WITH FOSTER WHEELER CORP.,  
C.C. JOHNSON & MALHOTRA P.C., RESOURCE  
APPLICATIONS, INC. AND R.E. BARRERA ASSOCIATES

EPA PM

D. HARKAY

TAT PM

S. MAY

FIGURE 2  
SITE MAP

PYRIDIUM MERCURY  
DISPOSAL SITE NO. 1

200017

## APPENDIX C

610002

ADDITIONAL DOCUMENTATION  
RELATING TO THIS SECTION  
CAN BE FOUND IN THE  
FOLLOWING SECTION:

SECTION: Administrative Record, Section 5.4  
DOCUMENT DATE: August 28, 1995  
DOCUMENT TITLE: Health Consultation, Pyridium Mercury  
Disposal Site #1, Orange County;  
Hanniman, New York, CERCLIS  
No. NY0000856237.

To	Richard Saiter	From	AL Rockmore
Co./Dept.	EPA	Co.	NY DEC
Phone	(908) 321-6658	Phone	(518) 457-9280
Fax	(908) 906-6182	Fax	(518) 457-7743

New York State Department of  
30 Wolf Road, Albany, New York, 12242

Langdon Marsh  
Commissioner

SEP 29 1994

Ms. Kathleen C. Callahan  
Director  
Emergency & Remedial Response Division  
United States Environmental  
Protection Agency  
Region II  
26 Federal Plaza  
New York, New York 10278

Dear Ms. Callahan:

Re: Pyridium Mercury Disposal Site  
Harriman (V) Orange County, N.Y.

I have enclosed a copy of a letter from the New York State Department of Health, dated September 9, 1994, regarding confirmed mercury contamination in the soil beneath five trailer homes at the referenced location in the Village of Harriman, Orange County, New York.

The trailer park is located near Nepera, Inc., Harriman, which is listed in the Registry of Inactive Hazardous Waste Disposal Sites in New York State as Site Code #3-36-006. We are presently trying to determine if the mercury contamination is related to the Nepera Site.

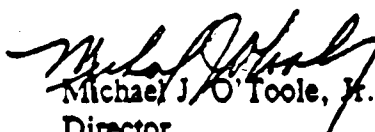
However, in the meantime, we hereby request that the USEPA conduct an Emergency Removal Assessment at the referenced location and initiate whatever response action is warranted by the findings of such an assessment and are authorized by CERCLA/SARA.

Ms. Kathleen C. Callahan

Page 2

If you have any questions regarding this request, please contact Alan Rockmore, P.E., of my staff, at (518) 457-9180.

Sincerely,



Michael J. O'Toole, Jr.

Director

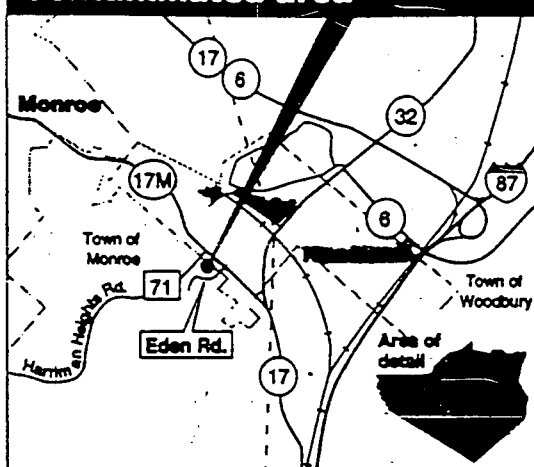
Div. of Hazardous Waste Remediation

Enclosure

cc: A. Carlson, NYSDOH  
R. Salkie - USEPA, Edison, New Jersey  
G. Zachos - USEPA, Edison, New Jersey  
J. Witkowski - USEPA, Edison, New Jersey



## Contaminated area



THE RECORD

# New year will bring new start

## Toxic site residents prepare to relocate

By AMY BETH TERDIMAN  
Staff Writer

HARRIMAN - The Lundgrens will start the new year with a new home after the trailer park site where they now live was found to be contaminated with toxic levels of mercury.

**"It was just a tragedy to have to move because of the mercury. But we are fine and life goes on. Now we're moving forward."**

— Vera Cox,  
resident

The Lundgrens and three other families living at the Route 17M site are expected to leave their mobile homes behind and move off the property by the end of January. All have reached agreements with Nepera Inc., a Harri-man-based chemical company that has agreed to pay for relocation costs.

The Cox family, which also lived at the Route 17M site until recently, moved to a trailer park down the road on Dec. 15.

"It was just a tragedy to have to move because of the mercury," said Vera

Cox. "But we are fine and life goes on. Now we're moving forward."

Cox would not say how much her settlement was, but said the money was used for a down payment on a new trailer. Her family rented one at the Route 17M site.

After the residents move, U.S. Environmental Protection Agency workers will begin cleaning up the site. Workers will likely decontaminate the trailers, move them, and haul away some 4,000 cubic yards of the white, claylike substance in the soil.

Workers will also scoop away about 500 cubic yards of contaminated soil from a second site at 40 S. Main St. The residents there will not have to move.

A chemical company called Pyridium Corp., which operated where Nepera now sits, is believed to have dumped calcium sulfate laced with poisonous mercuric sulfide at the two sites in the late 1940s to make the land there suitable for building.

Nepera has only agreed to pay to relocate the 16 people living at the trailer site. The company will not accept any responsibility or liability for the mercury contamination there.

It is not clear whether Pyridium Corp. is a direct ancestor of Nepera. Nepera is fighting in court with the Ladden Estate, Pyridium's former owners, over liability.

Tests showed readings as high as 653 times the normal concentration for mercury in the trailer park soil. Urine tests of the residents, however, did not find any unsafe levels of mercury.

Cindy Lundgren, who lives in a mobile home with her husband and son, had a baby boy on Dec. 16. Doctors say her baby is also free of mercury contamination.

"It's going to be a good start to the New Year," she said.

Have local news? Call city editor June E. Peoples 341-1100 Ext. 1409

orange county

# Experts expand soil tests

## *Fill at second Harriman site analyzed*

By AMY BETH TERDIMAN  
Staff Writer

— Federal and state officials have expanded soil testing to another site in the village — and found fill that looks like that uncovered at a contaminated trailer park.

Representatives of the U.S. Environmental Protection Agency and the state Health Department yesterday said they can't tell if the new site is contaminated with mercury, as is the trailer park on Route 17M, where fill was dumped in the 1940s to make it suitable for building.

"It looked like the same material that was found in the trailer site, but we won't know until it is analyzed," said Nina Knapp, a Health Department

spokeswoman.

Test results from the latest site and from the trailer park are expected this week.

Health and Village of Harriman officials said they wouldn't reveal the location of the site or the homeowner's name until they had received results from soil samples taken Friday. The site is within a quarter-mile of the five mobile homes on Route 17M where poisonous mercuric sulfide and calcium sulfate were found in the soil, Knapp said.

"It could be gypsum wallboard here for all I know," said Village Mayor Donald Humphrey. "We just want to be certain that we know what (the substance) is first for peace of mind."

Humphrey said a Harriman resident who lived in the area in the 1940s and '50s told the homeowner that trucks dumped fill into the swamp where the house now sits. The homeowner last week contacted the code enforcement officer, who then called the Health Department.

"We want to make sure we've turned this thing upside-down and examined everything," the mayor said. He encouraged residents who have concerns — or possible new leads — to contact him or the village's code enforcement officer.

Knapp said there was a low risk of contamination for the homeowner and neighbors because the white, claylike substance was found 5 to 6 inches under ground and had a layer of grass covering

it. Also, the house was built before the fill was dumped.

The homeowner was warned not to dig in the ground, Knapp said.

At the mobile home site, the white material was found on the soil's surface and was easy to see, she said. Those residents will be moved out of the park in coming weeks because of the high risk of contamination, she said.

The Health Department looked at three other sites for contamination but found no sign of the mercury compound, Knapp said. Test results show the village water system is safe.

Meanwhile, a relocation consultant from West Virginia will begin meeting with trailer park residents today to determine where the people will move and what it will cost. Nepera, a Harriman-based chemical company, has agreed to pay for the relocation.

Have local news? Call city editor June E. Peoples 341-1100 Ext. 1409

the region

# Love Canal lessons shared

By AMY BETH TERDIMAN  
Staff Writer

Lois Gibbs said she can understand the fears and frustrations of 16 Harriman residents who have to move their families after a poisonous compound was found on their property.

She went through a similar process in 1980 as one of 900 residents who had to be moved from Love Canal, a development near Niagara Falls where 20,000 tons of chemicals were discovered in the late 1970s.

"They could have given me \$10 for my house and land and I would have taken it just so I could get out of there," she said. "It's more the fear of possible health risks that stay with you. That never goes away."

The poisonous mercuric sul-

fide and calcium sulfate found around five mobile homes on Route 17M in Harriman are not nearly as dangerous or as widespread as the poisonous chemicals at Love Canal, but health officials say it is necessary to get people off the one-acre site as quickly as possible. How soon that will happen, officials cannot say.

Residents may have to give urine samples to health officials as early as next week to be tested for traces of mercury. If mercury is found in current residents' systems, tests may be expanded to include former residents, said Mark Van Valkenburg, of the State Department of Health.

Last weekend, workers from the Environmental Protection Agency collected about 90 samples of soil from the site to

determine where the contamination ends. Results should be available by the end of the month, said Joseph Rotola, EPA spokesman.

Officials at Nepera Inc., a Harriman-based chemical company, said they plan to hire a relocation consultant in coming weeks to help move the residents. The company has agreed to pay for the relocation until it finds the party responsible for dumping the contaminated fill.

The Pyridium Corp., which operated where Nepera is today, is believed to have dumped the fill in 1947 or 1948. The company was owned by the Lasdon brothers, said Peter Thauer, a lawyer for the Cambrex Corp., which owns Nepera.

Gibbs said she was pleased that the relocation process in Harriman has already started. It

took about two years for residents to convince health officials that they needed to move off the Love Canal site.

"It's not like a flood or natural disaster where you can say, 'OK, the house is destroyed. I broke my arm. The car was washed away,'" she said. "There you know your losses... In this case, you don't know till you get sick."

She and her family were given \$20,000 for their house, and \$500 to \$1,000 to move their belongings. They moved temporarily to the City of Niagara in 1980.

Soon after, they moved to Virginia, where she started the Citizens' Clearinghouse for Hazardous Waste for people with environmental problems. The organization has been involved in 15 other relocations in the country.

Gibbs offered the following

advice for residents living at the trailer park:

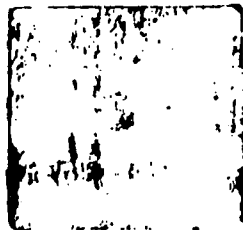
Hire one negotiator to represent the group when dealing with Nepera and EPA officials.

Hire an independent assessor to determine the value of the homes before interviews with the EPA and consultants begin.

Keep in mind the costs of future hook-ups for sewers, phone lines, water and other utilities when looking for a new home. Also include the cost to replace or to clean and move furniture.

Remember that money for relocation must be spent within two years or else it will be taxed.

The Citizens Clearinghouse published a 44-page book about the relocation process with tips for homeowners. For more information, call (703) 237-2249.



JEFF GOULDING/The Record

Environmental Protection Agency workers Joseph Rotola, left, and George Zachos, center, watch as a hired contractor Eric Wilson takes measurements during soil testing in Harriman yesterday.



# Harriman soil tests set

## Village residents fear spread of contamination

By AMY BETH TERDIMAN  
Staff Writer

**HARRIMAN** — The state Health Department plans to test several sites in the Village of Harriman for possible soil contamination.

It is hoped the testing will put residents' minds at ease.

Health and environmental officials say that poisonous mercuric sulfide and calcium sulfate found around five mobile homes on Route 17M have not extended beyond that site. But residents want to know for sure — hence, the additional testing in other areas.

"It's a very localized issue for now," said Mayor Donald Humphrey. "But if swamp fill was put there (at the trailer park), where else could it possibly be? We want to know."

About 200 residents turned out for a two-hour public

meeting Wednesday night to express fears that the contamination had spread to other areas. Health officials say it has not, and no evidence yet exists that other sites are contaminated.

Others approached Humphrey and the Health Department this week, suggesting other sites that might be, like the trailer park, filled-in swamp or wetlands.

Workers have already tested two sites — one off Route 17M by an abandoned bus garage, and the other off North Main Street, which runs parallel to the Ramapo River, he said. They found no evidence of contamination.

The Health Department has also said it would test soil near the two elementary schools in Harriman, but believes those sites are also pollution-free.

"This is just a sanity check to give everybody a little bit more peace of mind," said Mark Knudsen of the state Health Department.

Meanwhile, Environmental Protection Agency workers continue to test the soil around the trailer park to find exactly where the pollution ends. Testing should be finished by next week.

See TESTING page 12



300005



JEFF GOULDING/The Record

# Passing a test

Geologist Joe Filosa uses an instrument to detect the amount of mercury in the soil yesterday in a ~~variety of~~ test site. In the background, Eric Wilson pre-

pares another test. It is hoped the testing will put residents' minds at ease. Contamination near five mobile homes on Route 17M has raised concerns. Story, page 3.



NEWS INSIDE

**Conservationists sue for Sterling Forest land buy**

**BUSINESS**

Import or U.S. — '95 car labels to tell — page 40

**Bad start has Army in a hole**

— back page

**The Times Herald**

**RECORD**

LATE FINAL SOUTH Edition

Weather: Sunny; details on page 2      Middletown, N.Y. 10940      © Times Herald-Record      Thursday, October 13, 1994      .. 50 cents

# EPA workers scour trailer park pollution

— page 3



## Small copter, big task

A police helicopter hovers next to the Newburgh-Beech Bridge yesterday during a manhunt for an escapee. After several hours, the escapee was discovered hiding in the pilfers beneath the bridge. Story, page 3.

300006

# EPA searches for extent of contamination

By AMY BETH TERDIMAN  
Staff Writer

**Environmental Protection Agency** workers today will scour the area around a contaminated trailer park on Route 17M to find out exactly where the pollution ends.

About 200 Harriman residents packed the gymnasium of the Harriman Elementary School last night to express fears that the poisonous mercuric sulfide and calcium sulfate found in the soil around five mobile homes had somehow made its way into homes and drinking water throughout the village. Health officials say it has not.

"Right now, we know that the contamination is limited to the area of the trailer park, but we don't know the boundaries," said Village Mayor Donald Humphrey. "We know that the 16 people living there now have got to be moved."

And the village will receive results tomorrow of an emergency water test that specifically looks for mercury. A water test done in June showed no evidence of contamination.

"People are concerned about driving by the site or walking by the site," said one State Health Department official. "There is always the potential for exposure. But



A. TALBOT/THE RECORD

**Mark Knudsen of the New York State Department of Health explains what his department is doing about a toxic waste area in Harriman during a meeting last night at Harriman Elementary School.**

given the form that it's in, we believe it doesn't evaporate readily and can't be inhaled ... The risk from casual exposure is low."

State and federal environmental and health officials, along with village officials, spent nearly two hours last night trying to answer questions and allay fears.

Some residents wanted to know whether children cutting through the trailer park on their way to Route 17M could track the mercury compound into their homes. Others wanted to know whether employees at Nepera Inc., a Harriman-based chemical company near the site, were at risk. Traces of the mercury were found in soil taken from the company's parking lot.

But health officials could not answer their questions.

What they did know is that the people living at the site will possibly be moved within a month. Nepera has agreed for now to assume all costs for the relocation.

Hank Gross, who lived at the site from 1958 to 1970, said one of his sons has a nervous condition, the other has a skin disorder. He wanted to know whether their conditions were linked to the contamination.

"My kids played in that clay as if it were Play Dough," he said. "One of my sons sank to his waist in it and I had to yank him out."

Artie Block, of the Agency for Toxic Substances and Diseases Registry, said that organs or tissues may have been damaged by the mercury compound, but it would be difficult to establish a link now.

300008

# Mercury deposit remains a mystery

~~Nepera Chemical Corp.~~'s immediate offer to pick up the relocation costs for 16 residents of a nearby mercury-contaminated trailer park in the Village of Harriman is commendable. Nevertheless, disturbing questions about the contamination linger.

Namely, has it caused permanent health problems for anyone who came into contact with it? And how in the world could so much mercuric sulfide, dumped almost 50 years ago to fill swamps, go undetected for so long? The trailer park has been there for decades. Did no one wonder about the strange, milky-white substance that infested the soil in front, behind and underneath the trailers?

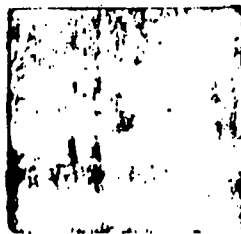
Apparently not. The material was not tested until after a contractor noticed the fill this past spring. The trailer property's trustee sent it to the state in July. Tests found readings as high as 653 times the normal concentration for mercury in the soil. Mercury can cause permanent damage to the brain, kidneys and developing fetuses. It can also affect memory.

Obviously, this mess will have to be cleaned up, but who will do it and how will it be done?

Despite its offer to relocate residents, Nepera may not be legally responsible for the contamination. The mercury was apparently dumped there by a now-defunct company, the ~~Pyridium~~ which operated on the site where Nepera is today. Pyridium may or may not be an ancestor of Nepera. That's another one of the questions that has to be answered. It is currently before the courts, but neither the state nor Nepera should wait for the verdict. They should start cleaning up the toxic fill as soon as residents are moved out. Figure out who foots the bill later.

**Did no one  
wonder about the  
strange, milky-  
white substance  
that infested the  
soil in front, behind  
and underneath  
the trailers?**





# Village water mercury free, mayor tells residents

By AMY BETH TERDIMAN  
Staff Writer

**HARRIMAN** — The Hedge family moved to Harriman in the late 1960s and raised four children in their trailer — all of whom have learning disabilities.

Now a lawyer representing the family says he thinks the children's condition is linked to the high concentrations of a mercury compound found in the soil at the Route 17M site.

"We feel that there is a strong probability that the waste there caused some neurological problems with these people," said Brian Sichel, who is representing the Hedges and the Lundgrens, another family who live on the site.

State health and federal environmental officials will meet at 10 a.m. today with representatives of Nepera Inc., a Harriman-based chemical company, to decide when and how to relocate the 16 people living in the trailer park. Nepera has agreed for now to assume all costs for the relocation.

Village of Harriman officials will hold a public meeting at 7:30 p.m. today to try to allay fears in the community that the mercury contamination has spread to other areas. It hasn't. Mayor Donald Humphrey

assured residents that the village's water system is mercury-free.

None of the village's eight groundwater wells is on the contaminated site. Mercury, which does not dissolve in water has not appeared in any tests, Humphrey said.

But several questions remain:

● Workers are now trying to determine where the contaminated soil ends, said a spokesman for the Environmental Protection Agency. "We're not concerned with how much is there right now, but where it is," said Joe Rotola.

To do that, workers dressed in protective white clothing and wearing respirators will start where mercury levels are highest — at about 635 parts per million. They will then move in circles around that spot, using stainless-steel spathulas to scoop soil into pint-sized glass jars, which will be sent away for testing.

Workers may also use an X-ray refraction machine, which takes a chemical snapshot of the soil.

With these methods workers will be able to say where contamination levels are normal — around 100 parts per million.

● State health officials have not yet decided how to monitor people liv-

ing at the site for possible health problems.

● Officials do not yet know how much it will cost to relocate people or what will happen to the site.

Some relocations have cost the EPA millions of dollars. In one case near Niagara Falls, 57 families had to move after dangerous chemical compounds were found in the soil. The site now sits empty.

Other cleanups were not so expensive. In 1988, EPA officials found mercury in the soil at another trailer park near Niagara Falls. Levels there were about 100 parts per million. Workers removed contaminated soil from the site while residents were at work during the day.

Health officials said it would be less expensive to move the Harriman residents than to clean up around them.

For now, the EPA said it has warned people living in the trailer park not to eat any vegetables that may have been grown in the soil and to make sure they do not track dirt and mud into their homes.

"It's basic housekeeping," Rotola said. "Don't play in the dirt. Don't track large white particles into the house on your shoes. And wipe your feet."

Long-term exposure to mercury can permanently damage the brain, kidneys and developing fetus. It has also caused some people to develop shakiness and memory loss. The most sensitive target to either long or short-term exposure is the nervous system. Full recovery is more likely after short-term than long-term exposure, once the contamination clears the body.

Exposure to mercury can be determined by testing blood and urine. The levels found there may show whether or not you'd be expected to have any health effects.

There is no information to show that mercury causes cancer in humans or animals.

Anyone with questions or information can call Nina Knapp at the state Health Department at 1-800-458-1158, ext. 402.

Source: U.S. Dept. of Health and Human Services

# Memory losses alarming

## Contractor fears mercury contact

By CHRISTOPHER MELE  
Staff Writer

**WALDEN** — Walden contractor Patrick Riffard at first thought it was old age creeping up on him. He'd be on his way with his wife, Dolores, to meet a customer when he would suddenly pull over.

"He'll say, 'Where are we going? I just blanked,'" Dolores Riffard said.

Patrick Riffard wonders if his memory losses are linked to two jobs he vividly remembers: working knee-deep in a mixture of soil muck and a "disgusting ... cement-like sludge" at a Harriman trailer park in 1992 and 1993.

It turns out that the "sludge" is a mercury compound, dumped at the Route 17M site with other fill nearly 50 years ago.

And, it also turns out, the mercury concentrations are so high that they're forcing 16 trailer tenants from their homes in perhaps as early as two weeks.

Exposure to mercury can permanently damage the kidneys, brain and developing fetuses. It can also lead to trouble remembering and concentrating.

"I have a hard time remembering what I did yesterday," Riffard, 46, said yesterday. "I don't know whether it's related (to the diggings) or to blame it on getting old. My wife and mother-in-law can't believe how forgetful I am."

Riffard wonders if his exposure to mercury has caused health problems.

Riffard and co-worker Dan Overton had to jackhammer through the 18-inch frost last year to install an electrical line. For days, they dug through the soil and white, cement-like muck.

"It was like chipping off soft stone," Overton said yesterday. "I remember saying to Riff, 'This isn't soil. I'm not happy to know I had my hands on mercury.'"



JEFF GOULDING/The Record

**Patrick Riffard of Walden installed an electrical conduit in this trailer in Harriman last year. He is concerned that recent losses of short-term memory**

Overton, 44, of Modena, said he's had no health problems.

No one knows for sure whether Riffard's medical problems are directly linked to mercury exposure, but state and federal health officials aren't taking any chances.

They are working with Nepera Inc., a Harriman chemical corporation, to relocate trailer park residents. A state health official said residents could be out as early as two weeks.

Tests at the site have shown readings as high as 653 times the normal concentration for mercury in soil.

Once residents are removed from the contamination source, any mercury that has accumulated in their bodies can begin breaking down, said Matthias Schleifer, assistant commissioner for environmental health at the Orange County Health Department.

Mercury has a half-life of 60 days. A chemical's half-life is the amount of time it takes for half of it to be degraded.

Health officials said they'll likely conduct "biological monitoring" of residents through urine analysis. If those

might be linked to his wading in mercury-laced sludge at the trailer park, a former dump site. Sixteen residents are to be evacuated.

tests show traces of mercury, officials will probably reach out to former residents.

Nepera is assuming the relocation costs and responsibility until those issues are ultimately sorted out. Another company that once operated on Nepera's current site, Pyridium Corp., is believed to have provided contaminated fill for the Route 17M site's swampy areas in 1947-48.

Pyridium Corp. manufactured pyridium for use in urinary tract infections. Mercury was a waste product from that manufacturing process.

"This is what we've been told" about the dumping, Nepera spokeswoman Judy Hoffman said last week. "There's nobody with firsthand knowledge of what happened."

Village of Harriman Mayor Donald Humphrey yesterday assured residents that the village's water system is mercury-free.

None of the village's eight groundwater wells are on the contaminated site; the closest one is three-quarters of a mile away, he said.

# A poison sewn into the soil

## Mercury compound found in trailer park

By CHRISTOPHER MELE

Staff Writer  
— Dawn McManus isn't sure what to think.

From 1976-79, she lived in one of five trailers set on a parcel off Route 17M in the Village of Harriman.

While she lived there, McManus had two miscarriages. After she moved, she had four children, three of whom have learning disabilities.

Fifteen years after McManus moved, health officials discovered that a mercury compound had been dumped nearly 50 years ago at the trailer site. Exposure to mercury can permanently damage the brain, kidneys and a developing fetus.

Tests show readings as high as 653 times the normal concentration for mercury in soil, according to state health officials.

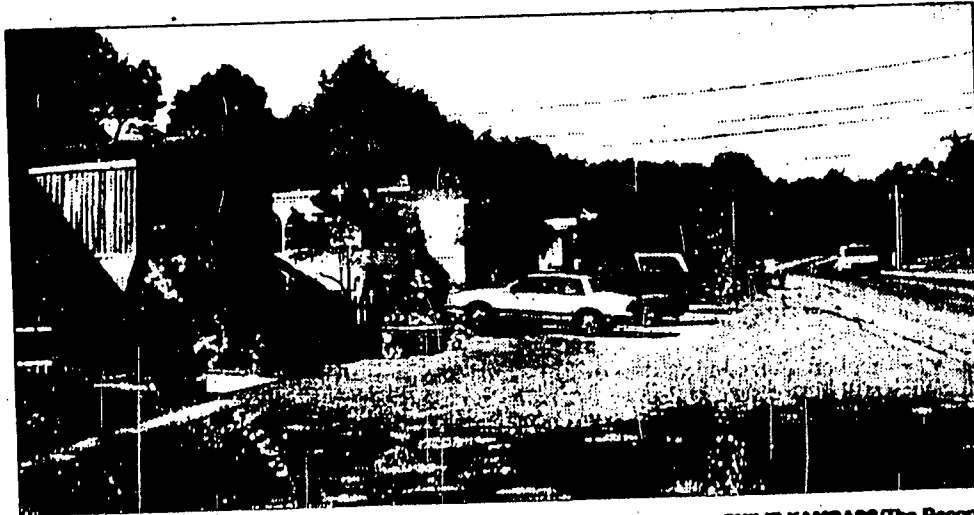
The milky white material that infests the soil in front, back and underneath the trailers is driving residents from their homes.

Now, state and federal officials, with the cooperation of Nepera Inc., a Harriman chemical corporation, are arranging to relocate the 16 residents as rapidly as possible.

McManus no longer lives at the site, but the mercury discovery raises nagging questions.

"I think maybe the miscarriages could have been because of the water I was drinking or the air I was breathing," said McManus, 37, who had problems with a bleeding kidney when she lived there. "But I don't know."

Federal and state officials don't know for



PHILIP KAMRASS/The Record

Health officials have discovered that a mercury compound was dumped nearly 50 years ago at a trailer site in Harriman. Route 17M is at right.

sure, either. But they do know that people should be removed from the site, where children once played with the mercury as if it were clay.

According to Nepera and state officials, the story unfolds this way:

Back in 1947-48, the Pyridium Corp., which operated on the site where Nepera is today, provided fill for swamps on the Route 17M property. The fill contained mercuric sulfide. No one knows for sure how much contaminated fill was dumped there, Nepera spokeswoman Judy Hoffman said yesterday.

This past spring, a contractor looking at underground storage tanks at a nearby transmission shop went behind the trailers and found the fill. The trailer property's trustee had the material tested and sent the results to the state in July, said Mark VanValkenburg, an environmental health specialist with the state Health Department.

Normally, mercury is found in soils in concentrations of less than 1 part per million. The 12 tests taken at the Route 17M site showed concentrations of 110 to 653 parts per million, VanValkenburg said.

One part per million is about one drop of

### How mercury affects the body



Exposure to either organic or inorganic mercury can permanently damage the:

- Brain
- Kidneys
- Developing fetuses

The kidneys, in particular, are susceptible to damage from mercury.

Mercury is typically found in soils at levels less than one part per million (ppm). The site in question has levels ranging from 110 to 653 ppm.

Anyone with questions or information can call Nina Knapp at the state Health Department at 1-800-458-1158, ext. 402

in 18 gallons of water.

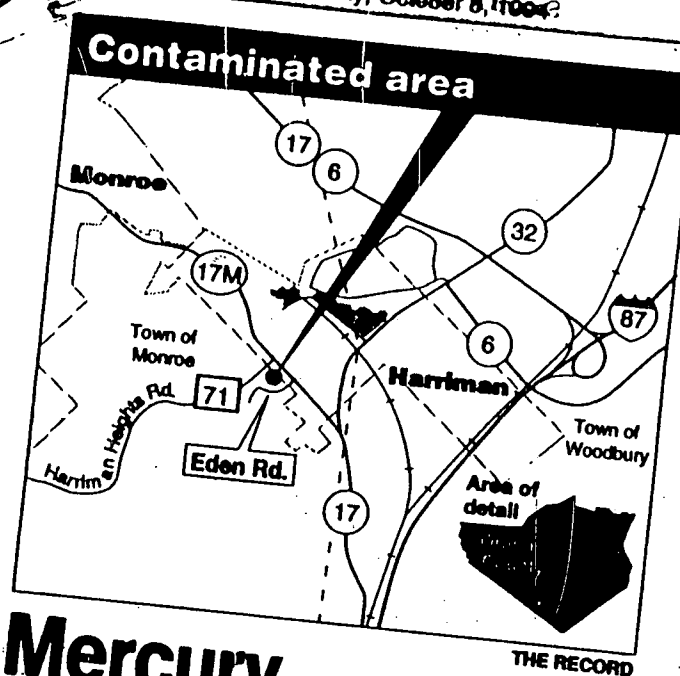
Mercury can be absorbed through the mouth and nose in breathing as well as through the skin. Residents said they've been told they can take all their belongings with them except for carpets, which can contain mercury residue or dust.

McManus still owns two trailers at the site, and she recently spent \$500 for to-wall carpeting. That's not all she has to lose: Because of the threat that residents would be continually exposed to mercury, the trailers will stay behind, residents

See MERCURY pa

Saturday, October 8, 1994

THE RECORD



## Mercury

From page 3

Hoffman of Nepera said the company is negotiating with the EPA to cover the relocation costs. She said it's not clear that Pyridium Corp. is a direct ancestor of Nepera's. Nepera is fighting with the estate of the former company's owners over liability in court.

"We will accept responsibility and fight about the bill later," Hoffman said yesterday. "We did not want to make people wait until legal things were settled."

VanValkenburg said state officials will likely analyze residents' urine for traces of mercury. If traces are found, officials may reach out to former tenants. Of the 16 people there now, some just moved in last week and some have been there 25 years, he said.

Meanwhile, trailer residents are facing upheavals in their lives. Some declined comment yesterday, saying they've retained lawyers.

McManus' 70-year-old father, Leonard Gulliano, moved into one of her trailers six weeks ago. He tried to fill sinkholes in his backyard with leaves and branches, not knowing the holes were contaminated with mercury.

Resident Paul Cox, who's lived in a trailer for three years with his mother and older brother, said they're not looking to make a buck off their woes.

"We just want to get relocated and get out of here," Cox said.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION II

-----X  
IN THE MATTER OF :  
THE PYRIDIUM DISPOSAL SITE, :

Nepera, Inc., :

Administrative Agreement and Action : Index Number  
Pursuant to Section 106(a) : II-CERCLA-95-0203  
of the Comprehensive Environmental :  
Response, Compensation, and Liability :  
Act, as amended, 42 U.S.C. § 9606(a). :  
-----X

I. JURISDICTION AND GENERAL PROVISIONS

1. Nepera, Inc., (hereinafter referred to as "Nepera") has agreed to perform the Work defined below and has agreed to enter into this Administrative Agreement ("Agreement") with the United States Environmental Protection Agency ("EPA") and to be bound to all the terms and provisions contained herein. This Agreement is entered into voluntarily, in the absence of any determination by EPA concerning Nepera's potential liability with respect to the activities addressed herein, and is not entered into in response to an enforcement action or threat of an enforcement action by EPA. This Agreement provides, in accordance with the provisions of a Work Plan, approved by EPA and annexed hereto and incorporated by reference herein, for Nepera's performance of activities with respect to the dissociation of residents from hazardous substances at, or relocation of residents from, the Pyridium Disposal Site (hereinafter, the "Site"), which is located in the Village of Harriman, Town of Monroe, Orange County, New York. The relocation activities required herein are to be conducted to abate an imminent and substantial endangerment to the public health, welfare, or the environment that may be presented by the actual or threatened release of hazardous substances at or from the Site.

2. This Agreement is entered, and the Order on Consent hereunder is issued, pursuant to the authority vested in the President of the United States by Section 106(a) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 U.S.C. § 9606(a), as amended ("CERCLA"), and delegated to the Administrator of the United States Environmental Protection Agency ("EPA") by Executive Order No. 12580, January 23, 1987, 52 Federal Register 2923, and further redelegated to the EPA Regional Administrators by EPA Delegation Nos. 14-14-A and 14-14-C.

3. EPA has notified the New York State Departments of Health ("NYSDOH") and Environmental Conservation ("NYSDEC") of this Agreement and the Order on Consent issued hereunder pursuant to Section 106(a) of CERCLA, 42 U.S.C. § 9606(a).

4. Neither Nepera's voluntary entering of this Agreement nor its performance of the terms and conditions of this Agreement, nor its compliance with the requirements of the Order on Consent issued hereunder, shall constitute or be construed as: an admission of any potential liability by Nepera as a responsible party pursuant to Section 107 of CERCLA, 42 U.S.C. § 9607; an admission of any other liability under CERCLA, or any other law, or otherwise, in connection with the Site; or as an admission of, or an agreement with, EPA's Findings and Conclusions of Law contained in Section IV., herein, or EPA's Determinations contained in Section V., herein. However, notwithstanding the foregoing, Nepera agrees to comply with and be bound by the terms of this Agreement. In any action by EPA to enforce the terms of this Agreement, Nepera further agrees that it will not contest the basis or validity of this Agreement, nor will it contest the authority or jurisdiction of the Regional Administrator of EPA Region II to enter into this Agreement.

## II. PARTIES BOUND

5. This Agreement applies to and is binding upon Nepera and Nepera's successors and assigns. Nepera agrees to the extent applicable to instruct its officers, directors, employees and agents involved in the performance of the Work required by this Agreement to cooperate in carrying out Nepera's obligations under this Agreement. Nepera agrees that its officers, directors, employees, and agents involved in the performance of the Work required by this Agreement shall take all necessary steps to accomplish the performance of said Work in accordance with this Agreement.

6. The individuals who have signed this Agreement on behalf of Nepera certify that they are authorized to bind Nepera to this Agreement. Any change in ownership or corporate status of Nepera, including any transfer of assets or real or personal property, shall not alter Nepera's responsibilities under this Agreement.

7. Nepera shall provide a copy of this Agreement and the Order on Consent issued hereunder to any subsequent owner or successor before ownership rights or stock or assets in a corporate acquisition are transferred.

8. Nepera shall ensure that its contractor(s), subcontractor(s), and representatives receive a copy of and comply with this Agreement and the Order on Consent issued hereunder. Nepera shall be responsible for any noncompliance with this Agreement and the Order on Consent issued hereunder.

## III. DEFINITIONS

9. Unless otherwise expressly provided herein, terms used in this Agreement which are defined in CERCLA or in regulations promulgated under CERCLA shall have the meaning assigned to them in CERCLA or

its implementing regulations. Whenever terms listed below are used in this Agreement, in an attachment to this Agreement, or in documents incorporated by reference into this Agreement, the following definitions shall apply:

a. "CERCLA" means the Comprehensive Environmental Response, Compensation and Liability Act, as amended, 42 U.S.C. §§ 9601-9675.

b. "day" means a calendar day unless otherwise expressly stated. In computing any period of time under this Agreement, where the last day would fall on a Saturday, Sunday, or Federal holiday, the period shall run until the close of business on the next working day.

c. "EPA" means the United States Environmental Protection Agency and any successor departments or agencies of the United States.

d. "hazardous substance" shall have the meaning provided in Section 101(14) of CERCLA, 42 U.S.C. § 9601(14).

e. "National Contingency Plan" or "NCP" means the National Oil and Hazardous Substances Pollution Contingency Plan promulgated under Section 105 of CERCLA, 42 U.S.C. § 9605, published at 55 Fed. Reg. 8666 (1990), and codified at 40 C.F.R. Part 300, including any amendments thereto.

f. "NYSDEC" means the New York State Department of Environmental Conservation.

g. "NYSDOH" means the New York State Department of Health.

h. "Party" or "Parties" means the United States Environmental Protection Agency and/or Nepera.

i. "Nepera" means Nepera, Inc., a corporation existing under the laws of the State of New York.

j. "Site" means the Pyridium Disposal Site located in the Village of Harriman, Town of Monroe, Orange County, New York, as more specifically described in Paragraph 10, below.

k. "State" means the State of New York.

l. "Waste" means (1) any "hazardous substance" under Section 101(14) of CERCLA, 42 U.S.C. § 9601(14); (2) any "pollutant or contaminant" under Section 101(33) of CERCLA, 42 U.S.C. § 9601(33); (3) any "solid waste" under Section 1004(27) of RCRA, 42 U.S.C. § 6903(27); and (4) any mixture containing any of the constituents noted in (1), (2) or (3), above.

m. "Work" means only the work and other activities required by Section VI, Subsections B. through F. of this Agreement.

n. "ATSDR" means the Agency for Toxic Substances and Disease Registry.

IV. EPA FINDINGS OF FACT AND CONCLUSIONS OF LAW (WHICH NEPERA NEITHER ADMITS NOR DENIES)

10. The approximately one acre parcel of land located near the corner of Routes 17M (Ramapo Avenue) and 71 (Harriman Heights Road) in the Village of Harriman, Town of Monroe, Orange County, New York, is known as section 103, lot 2, and block 5 on the tax map of Orange County, and is included within the Site. This parcel is occupied by an ongoing automobile transmission repair garage and a mobile home park, permitted and regulated by the Orange County Department of Health, which includes five single family trailer homes.

11. By a Health Consultation on September 30, 1994, the New York State Department of Health ("NYSDOH") advised EPA that soil samples taken at the Site and analyzed by the New York State Department of Environmental Conservation ("NYSDEC") detected mercury at levels which constituted a public health hazard for the thirteen persons who were residents of the trailer homes at that time. In consultation with the federal Agency for Toxic Substances and Disease Registry ("ATSDR"), the NYSDOH recommended, inter alia, that the residents of the trailer homes be dissociated from the wastes on the Site.

12. EPA conducted sampling at the Site on October 13, 14, and 15, 1994, and preliminary analyses of these samples confirmed the presence of mercury in Site soil samples in excess of levels utilized by ATSDR as health risk comparison values for determining unacceptable risks of adverse health effects due to potential exposure to mercury.

13. By telephone conference on October 12, 1994, representatives of ATSDR in consultation with representatives of the NYSDOH, advised and recommended to EPA personnel that the residents at the Site should not remain there and that these residents should have medical biomonitoring for the presence of mercury before they are dissociated from the Site.

14. Exposure through the potential exposure pathways of direct contact, ingestion, or inhalation to mercury can cause a variety of adverse and toxic effects to exposed population groups, especially children.

15. Upon information and belief, the waste materials present in the soil at the Site are waste products generated in the 1940s and



early 1950s by the Pyridium Corp. at its production facility in Harriman, New York which was situated less than one mile from the Site. These waste materials were produced in the production of pyridium, a pharmaceutical preparation. These wastes, which are believed to have contained mercuric sulfide, were apparently utilized as fill material in wetlands that were on the Site.

16. Pyridium Corp. ceased doing business at its Harriman production facility circa 1956. Subsequent to the cessation of Pyridium Corp.'s operations at the Harriman production facility, the production facility was owned and operated by a second pharmaceutical company which, in turn, sold the production facility to Nepera in 1958.

17. At the time that this matter was referred to EPA by the NYSDOH on September 30, 1994, Nepera, of its own accord, came forward and represented to EPA that, while it was not legally responsible or liable for the contamination at the Site, it would volunteer, as a concerned corporate member of the community, to relocate Site residents in accordance with the recommendations of the NYSDOH.

18. Nepera, a corporation duly organized and existing under the laws of the State of New York, is a "person" within the meaning of Section 101(21) of CERCLA, 42 U.S.C. § 9601(21). Based upon information available to it at this time, EPA has made no determinations whatsoever with respect to issues of potential liability pursuant to Section 107(a) of CERCLA, 42 U.S.C. § 9607(a).

19. The Site constitutes a "facility" within the meaning of Section 101(9) of CERCLA, 42 U.S.C. § 9601(9).

20. The mercury found at the Site as described in paragraphs 11 and 12 is a hazardous substance, as defined in Section 101(14) of CERCLA, 42 U.S.C. § 9601(14).

21. There have been and continue to be releases and/or threats of releases, within the meaning of Section 101(22) of CERCLA, 42 U.S.C. § 9601(22), of a hazardous substance from the Site.

22. The conditions described above constitute an actual or threatened "release" of a hazardous substance from the Site, as defined by Sections 101 (22) of CERCLA, 42 U.S.C. § 9601(22).

23. The conditions present at the facility may constitute a threat to public health, welfare, or the environment based upon the factors set forth in Section 300.415(b)(2) of the NCP. These factors include, but are not limited to, the following:

- i. actual or potential exposure to nearby human populations, animals or the food chain from hazardous substances or pollutants or contaminants;

- iv. high levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface, that may migrate.
- v. weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released.

24. As discussed in paragraphs 17 and 18, above, Nepera, in the absence of an EPA determination that it is liable pursuant to Section 107 of CERCLA, 42 U.S.C. § 9607, has discussed with EPA the Work Plan, annexed hereto as Exhibit A, and enters into this Agreement notwithstanding its denial of liability for response actions, or otherwise, at the Site. The actions required by this Agreement are necessary to protect the public health, welfare, or the environment, and are not inconsistent with the NCP or CERCLA.

#### V. EPA DETERMINATION (WHICH NEPERA NEITHER ADMITS NOR DENIES)

25. Based upon the Findings of Fact and Conclusions of Law set forth above, and the administrative record supporting this action, EPA has determined that the actual or threatened release of hazardous substances from the Site may present an imminent and substantial endangerment to the public health, welfare or the environment within the meaning of Section 106(a) of CERCLA, 42 U.S.C. § 9606(a).

#### VI. WORK TO BE PERFORMED

26. Nepera hereby agrees to implement the activities set forth in the annexed Work Plan which has been approved by EPA, in accordance with the requirements and schedule specified below. All activities specified below shall be initiated and completed as soon as possible even though maximum time periods for their completion may be specified herein.

##### A. Designation of Contractor, Project Coordinator, and On-Scene Coordinator

27. Nepera shall perform the Work required by this Agreement. Nepera may retain a contractor to perform the required actions. Nepera shall notify EPA of the name and qualifications of any selected contractor(s) or subcontractor(s) proposed to be retained to perform any portion of the Work Plan under this Agreement at least ten (10) days prior to commencement of such Work.

28. EPA retains the right to disapprove of any, or all, of the contractor(s) and/or subcontractor(s) proposed by Nepera. If EPA disapproves of a proposed contractor to conduct a portion of the Work Plan or if Nepera seeks to change the designated contractor, Nepera shall propose an alternate contractor, including providing its qualifications, within seven (7) days of EPA's disapproval or

Nepera's notification of intention to change the designated contractor.

29. Nepera shall provide a copy of this Agreement and the Order on Consent issued hereunder to each contractor and subcontractor retained to perform the Work. Nepera shall include in all contracts or subcontracts entered into for Work required under this Agreement provisions stating that such contractor(s) or subcontractor(s), including its agents and employees, shall perform activities required by such contracts in compliance with this Agreement and all applicable laws and regulations. Nepera shall be responsible for ensuring that its contractor(s) and subcontractor(s) perform the Work contemplated herein in accordance with this Agreement.

30. All activities required of Nepera under the terms of this Agreement shall be performed only by well-qualified persons possessing all necessary permits, licenses, and other authorizations required by federal, state, and local governments, and all Work conducted pursuant to this Agreement shall be performed in accordance with professional standards.

31. Nepera has designated Mr. Maurice Leduc as its Project Coordinator who shall be responsible for administration of all Nepera's actions required by this Agreement. To the greatest extent possible, the Project Coordinator shall be present at the Site or readily available during the performance of Work at the Site. EPA hereby approves of the appointment of Mr. Maurice Leduc as Nepera's Project Coordinator. Receipt by Nepera's Project Coordinator of any notice or communication from EPA relating to this Agreement shall constitute receipt by Nepera.

32. EPA has designated Joseph Rotola of EPA, Region II, Emergency and Remedial Response Division as its On-Scene Coordinator ("OSC"). Nepera shall direct all submissions required by this Agreement to the OSC. EPA and Nepera shall have the right, subject to the immediately preceding paragraph, to change its designated OSC or Project Coordinator. Nepera shall notify EPA five (5) days before such a change is made. The initial notification may be orally transmitted, but such notification shall be promptly followed by a written notice.

#### B. Work To Be Performed

33. Annexed hereto as Exhibit A is Nepera's detailed Work Plan (hereinafter the "Work Plan") to accomplish the prompt and expeditious dissociation from the Site of the sixteen persons believed to be resident at the Site ("Residents") at this time. The Work Plan describes each of the steps Nepera shall take to accomplish the dissociation. It also includes a time schedule for the accomplishment of each such step, except that the time for

finding "comparable replacement dwellings" shall be as promptly as is feasible. The Work Plan is limited in scope to the activities expressly set forth therein, and any other limited actions incidental to, and necessary to accomplish the purposes of, such activities. The provisions of the Work Plan have been designed to be, and are, consistent with the provisions of the Uniform Relocation Assistance and Real Property Act ("URARPAPA"), 42 U.S.C. § 4601 et seq., and regulations promulgated pursuant thereto (specifically, 49 CFR Part 24, Subparts C through F, thereof).

Nothing in this Agreement or in the Work Plan shall be deemed to require or obligate Nepera to conduct or to be responsible for any work or activities that are not specified in the Work Plan, including, for example, the remediation or the decontamination of real or personal property, or the acquisition of real or personal property (as may be authorized by the regulations contained at 49 CFR Part 24, Subpart B, or otherwise).

34. EPA hereby approves the Work Plan submitted by Nepera and annexed hereto as Exhibit A.

35. Nepera shall implement the Work Plan as approved by EPA in accordance with the schedule set forth therein.

36. The Work Plan (Exhibit A hereto), the schedule, and any subsequent modifications shall be fully enforceable under this Agreement and under the Order on Consent issued hereunder.

37. In the event that a dispute arises concerning the implementation of the Work Plan by Nepera pursuant to this Agreement, which cannot be resolved informally, Nepera shall notify EPA as promptly as possible but in no event later than seven (7) days after receipt of EPA disapproval or comment, or after Nepera has become aware, or reasonably should have become aware of the dispute.

38. If any plan, report, or other item required to be submitted to EPA for approval pursuant to this Agreement is disapproved by EPA, even after being resubmitted following Nepera's receipt of EPA's comments on the initial submittal, Nepera shall be deemed to be out of compliance with this Agreement. If any resubmitted plan, report, or other item, or portion thereof, is disapproved by EPA, EPA may again direct Nepera to make the necessary modifications thereto, and/or EPA may amend or develop the item(s) and recover the related costs from Nepera. Nepera shall implement any such item(s) as amended or developed by EPA.

39. EPA shall be the final arbiter in any dispute regarding the sufficiency or acceptability of all documents submitted and all activities concerning the relocation of Residents performed pursuant to this Agreement.

40. All plans, reports and other submittals required to be submitted to EPA pursuant to this Agreement shall, upon approval by EPA, be deemed to be incorporated into, and an enforceable part of, this Agreement.

C. Reporting

41. During the implementation of this Agreement, commencing with the first week following issuance of the Order on Consent issued hereunder and ending with the submission of the Final Report as provided below, Nepera shall provide weekly written response reports to the EPA On-Scene Coordinator, Joseph Rotola, at the address set forth in paragraph 42, below, which fully describe all Work undertaken pursuant to this Agreement, and describe all Work scheduled for the next two-week period.

Within seven (7) days after completion of all Work required under this Agreement, Nepera shall submit for EPA review and approval a Final Report summarizing the actions taken to comply with this Agreement. The Final Report shall conform, at a minimum, with the requirements set forth in Section 300.165 of the NCP entitled "OSC Reports." The Final Report shall include:

- a. a synopsis of all Work performed under this Agreement;
- b. a detailed description of all EPA-approved modifications to the Work Plan which occurred during Nepera's performance of the Work required under this Agreement;
- c. a listing of both temporary and permanent relocation activities including the addresses of housing selected;
- d. a itemized account of all costs associated with any relocation attempts that resulted in a cash out;
- e. accompanying appendices containing all relevant documentation generated during the Work (e.g., individual relocation plans, invoices, bills, contracts, leases and permits).

If EPA disapproves or otherwise requires any modifications to the Final Report to be submitted to EPA for approval pursuant to this Agreement, Nepera shall have fourteen (14) days from the receipt of notice of such disapproval or the required modifications to correct any deficiencies and resubmit the Final Report.

42. All other submittals, correspondence and notifications to EPA pursuant to this Agreement shall also be made in writing to the EPA On-Scene Coordinator, with copies to the following addressees:

1 copy to:

Joseph Rotola  
Emergency & Remedial Response Division  
Response and Prevention Branch  
United States Environmental Protection Agency  
2890 Woodbridge Avenue  
Edison, New Jersey 08837

1 copy to:

Patricia Seppi  
External Programs Division Branch  
U.S. Environmental Protection Agency  
26 Federal Plaza, Room 905  
New York, NY 10278

1 copy to:

New York/Caribbean Superfund Branch  
Office of Regional Counsel, Rm. 437  
United States Environmental Protection Agency  
26 Federal Plaza  
New York, New York 10278

Attention: George A. Shanahan, Esq.

1 copy to:

Michael O'Toole, P.E.  
Director, Hazardous Waste Remediation  
New York State Department of Environmental Conservation  
50 Wolf Road, Room 212  
Albany, New York 12233-7010

Attention: Pyridium Disposal Site

1 copy to:

Alan Clause, P.E.  
New York State Department of Environmental Conservation  
Region 3 Headquarters  
21 South Putt Corners Road  
New Paltz, New York 12561

1 copy to:

Dr. G. Anders Carlson  
New York State Department of Health  
Center for Environmental Health  
2 University Place  
Albany, New York 12203-3399

#### F. Community Relations

43. Nepera shall continue to cooperate with EPA in providing information relating to the Work required hereunder to the public. To the extent requested by EPA, Nepera shall participate in the preparation of all appropriate information disseminated to the public and in public meetings which may be held or sponsored by EPA to explain activities at or concerning the Site.

#### G. Access to Information

44. Nepera shall provide EPA with access to all records and documentation related to conditions at the Site and the Work conducted pursuant to this Agreement. All data, information, and records created, maintained, or received by Nepera or its contractor(s) or consultant(s) in connection with the implementation of the Work under this Agreement, including contractual documents, invoices, receipts, work orders and records, shall be made available to EPA upon request. EPA shall be permitted to copy all such documents.

45. Notwithstanding any other provision of this Agreement, EPA hereby retains all of its information gathering, access, and inspection authority under CERCLA, RCRA, and any other applicable statute or regulations.

#### H. Record Retention, Documentation, Availability of Information

46. Nepera shall preserve all documents and information relating to Work performed under this Agreement, or relating to the hazardous substances found on or released from the Site, for ten years following completion of the Work required by this Agreement. At the end of the ten year period, Nepera shall notify EPA thirty (30) days before any document or information is destroyed that such documents and information are available for inspection. Upon request, Nepera shall provide EPA with the originals or copies of such documents and information to EPA. In addition, Nepera shall provide documents and information retained under this section at any time before expiration of the ten year period at the written request of EPA.

47. All documents submitted by Nepera to EPA in the course of implementing this Agreement shall be available to the public unless identified as confidential by Nepera pursuant to 40 CFR Part 2, Subpart B, and determined by EPA to merit treatment as confidential business information in accordance with applicable law. In addition, EPA may release all such documents to NYSDEC and NYSDOH, and NYSDEC and NYSDOH may make those documents available to the public unless Nepera conforms with applicable New York law and regulations regarding confidentiality. Nepera shall not assert a claim of confidentiality regarding any existing monitoring or

hydrogeologic data relevant to the Site which it may have (or which it may develop in the future independent of this Agreement), or any information specified under Section 104(e)(7)(F) of CERCLA relating to the Work performed hereunder; nor shall Nepera assert a claim of confidentiality regarding any other chemical, scientific, or engineering data relating directly to the Work performed hereunder.

48. Nepera shall maintain an updated log of any documents for which it wishes to assert a claim of privilege. The updated log shall contain, on a document-by-document basis, the date, author(s), addressee(s), subject, the privilege or grounds claimed (e.g., attorney work product, attorney-client), and the factual basis for assertion of the privilege. Nepera shall keep the "privilege log" on file and available for inspection. EPA may at any time challenge claims of privilege.

#### J. Compliance With Other Laws

49. All Work shall be performed in accordance with all applicable local, state, and federal laws and regulations except as provided in CERCLA § 121(e), 42 U.S.C. § 9621(e), and Section 300.415(i) of the NCP.

50. Notwithstanding any other provision in this Agreement, and in accordance with Section 121(e)(1) of CERCLA, 42 U.S.C. § 9621(e)(1), no federal, state, or local permit shall be required for any portion of the Work required hereunder that is conducted entirely on-site, although Nepera must comply with the substantive requirements that would otherwise be included in such a permit. This Agreement is not, nor shall it act as, a permit issued pursuant to any federal or state statute or regulation.

#### VII. AUTHORITY OF THE EPA ON-SCENE COORDINATOR

51. The OSC shall be responsible for overseeing Nepera's implementation of this Agreement. The OSC shall have the authority vested in an OSC by the NCP to halt, conduct, or direct any Work required by this Agreement. Absence of the OSC from the Site shall not be cause for stoppage of Work unless specifically directed by the OSC.

#### VIII. FORCE MAJEURE

52. Nepera agrees to perform all requirements under this Agreement within the time limits established under this Agreement, unless the performance is rendered impossible or delayed by an event which constitutes "force majeure". For purposes of this Agreement, "force majeure" is defined as any event arising from causes entirely beyond the control of Nepera or of any entity controlled entirely by Nepera, including its contractor(s) and



subcontractor(s), that results in a delay or prevents performance of any obligation under this Agreement despite Nepera's best efforts to fulfill the obligation. "Force majeure" does not include financial inability to complete the Work or increased cost of performance.

53. Nepera shall orally notify the EPA On-Scene Coordinator if circumstances have occurred or are likely to occur which may delay or prevent the performance of any activity required by this Agreement, regardless of whether those circumstances constitute a force majeure. If the On-Scene Coordinator cannot be reached, Nepera shall leave a message at his or her office. In addition, Nepera shall notify EPA in writing within seven (7) days after the date when Nepera first become aware or should have become aware of the circumstances which may delay or prevent performance. Such written notice shall be accompanied by all available and pertinent documentation, including any relevant third-party correspondence, and shall contain the following: (a) a description of the circumstances, and Nepera's rationale for interpreting such circumstances as being beyond its control (should that be Nepera's claim); (b) the actions (including pertinent dates) that Nepera has taken and/or plans to take to minimize any delay; and (c) the date by which or the time period within which Nepera proposes to complete the delayed activities. Such notification alone shall not relieve Nepera of any of its obligations under this Agreement. Nepera's failure to timely and properly notify EPA as required by this paragraph shall constitute a waiver of Nepera's right to claim an event of "force majeure". The burden of proving that an event constituting a "force majeure" has occurred shall rest with Nepera.

54. If EPA determines a delay in performance of a requirement under this Agreement is or was attributable to a "force majeure" event, the time period for performance of that requirement shall be extended as deemed necessary by EPA. Such an extension shall not alter Nepera's obligation to perform or complete other tasks required by the Agreement which are not directly affected by the "force majeure" event.

#### IX. STIPULATED AND STATUTORY PENALTIES

55. If Nepera fails, without prior EPA approval, to comply with any of the requirements or time limits set forth in or established pursuant to this Agreement and the Order on Consent issued hereunder, and such failure is not excused under the terms of Section VIII (Force Majeure), Nepera shall, upon demand by EPA, pay a stipulated penalty to EPA in the amount indicated below for each day of noncompliance:

#### Days After Required Date

#### Stipulated Penalty

1 to 15 days

\$ 750.00/day

16 to 25 days	\$ 1,250.00/day
26 to 40 days	\$ 2,000.00/day

Any such penalty shall accrue as of the first day after the applicable deadline has passed and shall continue to accrue until the noncompliance is corrected, through the 40th day of such noncompliance. The payment of any such penalties shall be made by cashier's or certified check, made payable to the "Hazardous Substance Superfund," with a notation of the index number of this Order (Index Number II-CERCLA-95-0203), and it shall be mailed to the following address:

EPA - Region II  
Attn: Superfund Accounting  
P.O. Box 360188M  
Pittsburgh, PA 15251

Such payments shall also be accompanied by a letter of explanation from Nepera including the name of the Site (the Pyridium Disposal Site), and the EPA Region number (EPA Region II); a copy of the letter and the check shall be sent to the EPA addressees listed in paragraph 42, above. Late payments shall accrue interest at the rate of interest on investments of the Hazardous Substance Superfund, in accordance with Section 107(a) of CERCLA.

56. Even if violations are simultaneous, separate penalties shall accrue for separate violations of this Agreement. Penalties accrue and are assessed per violation per day. Penalties shall accrue regardless of whether EPA has notified Nepera of a violation or an act of noncompliance. The payment of penalties shall not alter in any way Nepera's obligation to complete the performance of the Work required under this Agreement.

57. Violation of any provision of this Agreement and the Order on Consent issued hereunder may subject Nepera to civil penalties of up to twenty-five thousand dollars (\$25,000) per violation per day, as provided in Section 106(b)(1) of CERCLA, 42 U.S.C. § 9606(b)(1). Should Nepera violate this Agreement or any portion thereof, EPA may carry out the required actions unilaterally, pursuant to Section 104 of CERCLA, 42 U.S.C. § 9604, and/or may seek judicial enforcement of this Agreement and the Order on Consent issued hereunder pursuant to Sections 106 and 107 of CERCLA, 42 U.S.C. §§ 9606 and 9607.

#### XI. RESERVATION OF RIGHTS

58. Except as specifically provided in this Agreement, nothing herein shall limit the power and authority of EPA or the United States to take, direct, or order all actions necessary to protect public health, welfare, or the environment or to prevent, abate, or minimize an actual or threatened release of hazardous substances, pollutants or contaminants, or hazardous or solid waste on, at, or from the Site. Further, nothing herein shall prevent EPA from

seeking legal or equitable relief to enforce the terms of this Agreement, from taking other legal or equitable action as it deems appropriate and necessary, or from requiring any person or entity, including Nepera, in the future to perform additional activities pursuant to CERCLA or any other applicable law. EPA reserves the right to bring an action against any person or entity, including Nepera, under Section 107 of CERCLA, 42 U.S.C. § 9607, for recovery of any response costs incurred by the United States related to this Agreement or the Site and which are not otherwise reimbursed by Nepera.

## XII. OTHER CLAIMS

59. By entering this Agreement or issuance of the Order on Consent hereunder, the United States and EPA assume no liability for injuries or damages to persons or property resulting from any acts or omissions of Nepera or Nepera's employees, agents, contractors, or consultants in carrying out any action or activity pursuant to this Agreement. The United States or EPA shall not be deemed a party to any contract entered into by Nepera or its directors, officers, employees, agents, successors, representatives, assigns, contractors, or consultants in carrying out actions pursuant to this Agreement.

60. Nothing in this Agreement constitutes a satisfaction of or release from any claim or cause of action against Nepera or any person not a party to this Agreement for any liability that such person may have under CERCLA, other statutes, or the common law, including any claims of the United States for costs, damages, and interest under Sections 106(a) and 107(a) of CERCLA, 42 U.S.C. §§ 9606(a) and 9607(a).

61. Nothing in this Agreement shall affect any right, claim, interest, defense, or cause of action of any party hereto with respect to third parties.

62. Nothing in this Agreement shall be construed to constitute preauthorization under Section 111(a)(2) of CERCLA, 42 U.S.C. § 9611(a)(2), and Section 300.700(d) of the NCP.

63. Notwithstanding its position that it would be entitled to claims for reimbursement for Work it agrees to perform at the Site, Nepera hereby waives any rights or claim it may have to seek reimbursement under Sections 106(b), 111, and 112 of CERCLA, 42 U.S.C. §§ 9606(b), 9611, and 9612, or any other provision of law, against the United States or the Hazardous Substance Superfund relating to costs incurred by Nepera in the performance of the Work at the Site. As provided in Paragraph 61, above however, nothing contained in this Paragraph shall be construed to affect any rights or claims Nepera may have with respect to third parties.

64. No action or decision by EPA pursuant to this Agreement shall give rise to any right to judicial review except as set forth in Section 113(h) of CERCLA, 42 U.S.C. § 9613(h).

### XIII. INDEMNIFICATION

65. Nepera agrees to indemnify, save, and hold harmless the United States, its agencies, departments, officials, agents, contractors, subcontractors, employees, and representatives from any and all claims, causes of action, damages, and costs of any type or description by third parties for any injuries or damages to persons or property resulting from acts or omissions of Nepera, its officers, directors, officials, agents, servants, receivers, trustees, successors, or assigns as a result of the fulfillment or attempted fulfillment of the terms and conditions of this Agreement by Nepera.

66. Claims or causes of action referenced in the preceding paragraph include claims or causes of action (a) arising from, or on account of, acts or omissions of Nepera, Nepera's officers, heirs, directors, employees, agents, contractors, subcontractors, receivers, trustees, successors or assigns, in carrying out Work pursuant to this Agreement, and (b) for damages or reimbursement arising from or on account of any contract, agreement, or arrangement between Nepera and any persons for performance of Work on or relating to the Site.

67. Nepera agrees to pay the United States all costs incurred by the United States, including litigation costs arising from or on account of claims made against the United States, based on any of the acts or omissions referred to in the two preceding paragraphs.

### XIV. INSURANCE

68. Prior to commencing any Work at the Site, Nepera shall secure and maintain for the duration of the Work under this Agreement adequate insurance coverage in light of the potential risks associated with the Site, including comprehensive general liability and automobile insurance, naming as insured the United States. In addition, for the duration of the Work under this Agreement, Nepera shall satisfy all applicable laws and regulations regarding the provision of workers' compensation insurance. Such insurance shall name as insured all contractors and subcontractors acting on behalf or under the control of Nepera in connection with any Work at the Site. If Nepera demonstrates by evidence satisfactory to EPA that any contractor or subcontractor maintains insurance equivalent to that described above, or insurance covering the same risks but in a lesser amount, Nepera need only provide that portion of the insurance described above which is not maintained by such contractor or subcontractor.

## XV. MODIFICATIONS

69. Modifications to any plan or schedule may be made in writing by the OSC or at the OSC's direction. If the OSC makes an oral modification, it will be memorialized in writing within seven (7) days; provided, however, that the effective date of the modification shall be the date of the OSC's oral direction. Any other requirements of the Agreement or of the Order on Consent issued hereunder may be modified in writing by mutual agreement of the parties.

70. If Nepera seeks permission to deviate from the Work Plan or schedule, Nepera's Project Coordinator shall submit a written request to EPA for approval outlining the proposed Site Work Plan modification and its basis.

71. No informal advice, guidance, suggestion, or comment by EPA regarding reports, plans, specifications, schedules, or any other writing submitted by Nepera shall relieve it of its obligation to obtain such formal approval as may be required by this Agreement and to comply with all requirements of this Agreement unless it is formally modified.

## XVI. TERMINATION AND SATISFACTION

72. Upon completion of all activities required pursuant to this Agreement, Nepera shall submit to EPA a Final Report detailing that the activities satisfy the requirements of the Agreement. EPA will provide prompt written notice to Nepera upon EPA's determination, after review of the Final Report, that all Work has been fully performed in accordance with this Agreement. Such notification shall not affect any continuing obligations of Nepera; if EPA determines that any Work has not been completed in accordance with this Agreement, EPA will notify Nepera, provide a list of the deficiencies, and require that Nepera correct such deficiencies. The Final Report shall also include the following certification signed by a person who supervised or directed the preparation of that report:

"Under penalty of law, I certify that to the best of my knowledge, after appropriate inquiries of all relevant persons involved in the preparation of the report, the information submitted is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

## XVII. SEVERABILITY

73. If a court issues an order that invalidates any provision of this Agreement or the Order on Consent issued hereunder or finds

that Nepera has sufficient cause not to comply with one or more provisions of this Agreement or the Order on Consent issued hereunder, Nepera shall remain bound to comply with all provisions of this Agreement not invalidated or determined to be subject to a sufficient cause defense by the court's order.

#### XVIII. EFFECTIVE DATE AND EFFECT OF CONSENT

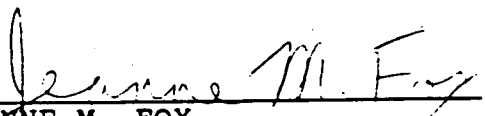
74. This Agreement and the Order on Consent issued hereunder shall become effective on the date of its receipt by counsel for Nepera. All times for performance of actions or activities required herein will be calculated from said effective date.

75. By signing and taking actions under this Agreement, Nepera does not necessarily agree with the Findings of Fact and Conclusions of Law contained herein. Nepera does not admit any legal liability or waive any defenses or causes of action with respect to issues addressed in this Agreement, except as otherwise provided in this Agreement.

#### XIX. ORDER ON CONSENT

All of the terms and conditions of the foregoing Agreement between Nepera and EPA as set forth in Sections I. through XVIII., above, are incorporated by reference herein and hereby so ordered by the Regional Administrator, EPA Region II, pursuant to Section 106(a) of CERCLA, 42 U.S.C. § 9606(a) and authority delegated to Regional Administrators as referenced in Paragraph 2, above. Notwithstanding the provisions of Paragraph 4, Nepera agrees to comply with and be bound by the terms of this Order, and further agrees that, in any action by EPA to enforce, or otherwise require compliance by Nepera with the terms of this Order, that it will not contest the basis or validity of this Order nor will it contest the authority or jurisdiction of the Regional Administrator of EPA Region II to issue this Order.

U.S. ENVIRONMENTAL PROTECTION AGENCY

  
JEANNE M. FOX  
Regional Administrator  
U.S. Environmental Protection Agency  
Region II

11/28/94  
Date of Issuance

CONSENT

Nepera, Inc. has had an opportunity to confer with EPA to discuss the terms of the foregoing Agreement and the issuance of the Order on Consent issued thereunder. Nepera, Inc. hereby consents to all of the terms of the foregoing Agreement and to the issuance of the Order on Consent issued thereunder and to its terms. Furthermore, the individual signing this Consent on behalf of Nepera, Inc. certifies that he or she is fully and legally authorized to agree to all of the terms of the foregoing Agreement and to bind Nepera, Inc. to the Order on Consent issued thereunder.

NEPERA, INC.

BY:

Peter E. Thawer

November 28, 1994  
DATE

PETER E. THAWER  
(printed name of signatory)

VICE PRESIDENT  
(title of signatory)

{CORPORATE SEAL}

**EXHIBIT A****RELOCATION WORK PLAN**  
**PYRIDIUM SITE, HARRIMAN, NY**

Nepera, Inc. (Nepera) has developed this Work Plan in accordance with the Administrative Agreement to which it is annexed (Agreement).

There exists an approximately one acre parcel of land near the corner of Routes 17M (Ramapo Avenue) and 71 (Harriman Heights Road) in the Village of Harriman, Town of Monroe, Orange County, New York, which has recently come to be known as the Pyridium Site as defined in the Agreement (Site). This parcel is occupied by an on-going automobile transmission repair garage and a mobile home park, which includes five single family trailer homes. As of September 30, 1994, thirteen people lived in these homes; as of November 14, however, there are sixteen residents (Residents). Nine (9) of the Residents live in three rented trailers owned by non-residents; the remaining Residents own the two trailers in which they reside.

The following are the Residents (see map):

1. Trailer #1: Mrs. Paul Cox and her two children rent the trailer home.
2. Trailer #2: Alvaro and Lorie Nieves had been living at the Site, but have been continuously absent from the trailer home since some time in September 1994.

Note: One adult and two children began living in the trailer home at the beginning of October 1994.

3. Trailer #3: Edgar and Linda Hedges and their two children own their trailer home.
4. Trailer #4: Mr. L. Giuliano rents the trailer home.
5. Trailer #5: Kenneth and Cindy Lundgren and their child own their trailer home.

During an investigation to determine the source of freon contamination in a Harriman drinking water well, local officials found material containing mercuric sulfide at the Site. After conducting additional sampling at the Site, the New York State Department of Health (NYSDOH) in consultation with the Agency for Toxic Substances Disease Registry (ATSDR) recommended that the Residents of the trailer homes on the Site be dissociated from the wastes on the Site. Since that time, the United States Environmental Protection Agency (EPA) has conducted sampling at the Site to determine the extent of contamination and has been meeting



with the Residents to answer their questions. Nepera, as a concerned corporate citizen in the Village of Harriman, has volunteered to relocate the Residents without admitting any liability or connection with the Site. Nepera is taking this voluntary step to address the concerns of the residential neighbors, even though Nepera has disclaimed any responsibility and liability for the placement of any material at the Site and EPA has not made any determination concerning potential liability. Additionally, Nepera has offered its cooperation to EPA in the identification of potentially responsible parties. Nepera and EPA are entering into the Agreement and Nepera has prepared this Work Plan to effect the relocation of the Residents.

Nepera has developed this Work Plan consistent with the provisions of URARPAPA and applicable implementing regulations 49 CFR Part 24, Subpart C through F (Regulations). The scope of Nepera's obligations under this Work Plan is limited to assisting the Residents of the Site in the following:

- a. providing relocation planning assistance;
- b. identifying comparable replacement housing;
- c. providing appropriate replacement housing payment offers;
- d. providing moving and related expense payments;
- e. assuming the costs for an initial mercury bio-monitoring screen of the Residents;
- f. providing the owner-occupants (Trailers #3 and #5) with temporary housing at reasonable cost, if necessary; and
- g. any other ~~limited~~ actions (reasonably limited in cost and scope) incidental to and necessary to accomplish, the purposes of a-f above.

Nepera shall not acquire any real or personal property of the Residents, nor assume any related ownership responsibility of such real or personal property, nor address any claims by non-residents of the Site. Additionally, Nepera's obligations under this Work Plan and the Agreement shall not extend to Site investigations, monitoring or remediation.

The following activities have been or will be conducted under this Work Plan and the Agreement:

1. Nepera has selected Mr. Maurice Leduc, Director, Regulatory Affairs, Nepera as the Project Coordinator for the implementation of this Work Plan and the Agreement and EPA has accepted such selection.

2. On October 5, 1994 the NYSDOH informed the Residents that they would be required to relocate from the trailer park and that Nepera had agreed to pay for the costs of such relocation.
3. On October 21, 1994 Nepera hired Mr. Lawrence Kitts, a relocation contractor experienced in emergency relocations. Mr. Kitts has assisted Nepera in determining specific information (which shall remain confidential, to the extent possible) regarding the Residents used to identify comparable replacement housing options. EPA has approved of Nepera's selection of Mr. Kitts. Nepera has also retained Ms. Laura Jean Codak, a mobile home property specialist, also approved by EPA, to assist Nepera in locating comparable or alternate replacement mobile homes for Residents, so desiring.
4. Mr. Kitts has interviewed all Residents but Alvaro and Lorie Nieves, the original occupants of Trailer #2. Mr. Kitts has been unable to interview these residents due to their continued absence from the Site. The interviews were conducted to identify the specific needs of the Residents and develop information (which shall remain confidential, to the extent possible) necessary to identify comparable replacement housing options.
5. Based on the information developed by Mr. Kitts, Nepera has identified potential comparable replacement housing options for the Residents and developed a plan for housing payments (which includes payments as identified in a-d, above and which shall remain confidential to the extent possible) taking into account the specific needs and desires of the Residents. The following is a summary of those plans:
  - a. The Cox family, who rent Trailer #1 are eligible as 90-day occupants under the Regulations. Mr. Kitts and Ms. Codak will be assisting Nepera with locating comparable or alternate replacement housing for the Cox family. As 90-day occupants, the Cox family is eligible for a rental differential payment and a moving expense payment, the total of which is listed on the attached confidential Schedule 1 and which Nepera and EPA shall keep confidential, to the maximum extent possible.
  - b. Alvaro and Lorie Nieves, the original tenants of Trailer #2 have been continuously absent from the home. Apparently, Alvaro no longer resides in trailer #2. By December 2, 1994, Nepera will send a registered letter to Lorie which explains her eligibility under the Regulations and the assistance Nepera will provide as identified herein. Lorie may be eligible as a 90-day occupant under the Regulations. If so, Lorie would be eligible for a rental differential payment and a moving expense payment, the total of which is listed on the attached confidential Schedule 1 and which Nepera and EPA shall keep confidential, to the maximum extent

possible.

**NOTE:** The express provisions of the Regulations would not entitle the present occupants of Trailer #2 to a replacement housing payment. Nevertheless, Nepera will provide relocation planning assistance and actual reasonable moving expenses, the total of which is listed on the attached confidential Schedule 1 and which Nepera and EPA shall keep confidential, to the maximum extent possible.

- c. The Hedges family, who own Trailer #3 are eligible as 180-day homeowner-occupants under the Regulations. Mr. Kitts and Ms. Codak will be assisting Nepera with locating comparable or alternate replacement housing for the Hedges. As 180-day homeowner-occupants, the Hedges family is eligible for a housing payment, the total of which is listed on the attached confidential Schedule 2 and which Nepera and EPA shall keep confidential, to the maximum extent possible. Nepera also will provide this family with temporary housing, at reasonable cost, consistent with the health consultation from NYSDOH and ATSDR, if such temporary relocation should become advisable in the light of the relocation schedule and the resident so desires to temporarily relocate.
- d. Mr. L. Giuliano, who lives in Trailer #4 is eligible as a 90-day occupant under the Regulations. He has indicated that he desires to relocate to alternate housing with the assistance of family members. Mr. Kitts and Ms. Codak will assist Mr. Giuliano with locating comparable or alternate replacement housing, if requested by Mr. Giuliano. As a 90-day occupant, Mr. Giuliano is eligible for a rental differential payment and a moving expense payment, the total of which is listed on the attached confidential Schedule 1 and which Nepera and EPA shall keep confidential, to the maximum extent possible.
- e. The Lundgren family, who own Trailer #5 are eligible as 180-day homeowner-occupants under the Regulations. The Lundgren family has stated their desire to purchase alternate housing, have requested a cash-out housing payment and have declined relocation planning assistance. As 180-day homeowner-occupants, the Lundgren family is eligible for a housing payment, the total of which is listed on the attached confidential Schedule 3 and which Nepera and EPA shall keep confidential, to the maximum extent possible. Nepera also will provide this family with temporary housing, at reasonable cost, consistent with the health consultation from NYSDOH and ATSDR, if such temporary relocation should become advisable in the light of the relocation schedule and the resident so desires to temporarily relocate.

6. EPA is planning a Public Availability Session to address the Residents' concerns and questions. EPA expects to hold this session during the week of November 28, 1994. Nepera will be available to EPA to plan and assist in the implementation of this session, as needed.
7. No later than December 2, 1994, Nepera will present to the Residents an explanation of the Regulations, including eligibility, relocation procedure and a replacement housing payment offer. Such offers are based on the information set forth in 5 a-d, above. Nepera will issue checks to those accepting the cash-out housing payment offer, upon execution of an appropriate release (in the form of the attached confidential Schedule 4, which Nepera and the EPA will keep confidential to the maximum extent possible) by the Residents, or at a later time, if requested by the Residents. Mr. Kitts and Ms. Codak shall be available to Residents requiring assistance to locate comparable or alternate housing.
8. Nepera is not acquiring any property, real or personal, nor is it assuming responsibility for any related ownership obligations, including, but not limited to, maintenance of property or trailers, provisions of insurance, security, etc.
9. Nepera's obligations under this Work Plan and the Agreement shall be fulfilled once a Resident has accepted a replacement housing payment offer. Should a Resident refuse to accept the replacement housing payment and offer of relocation assistance, Nepera shall notify EPA of such refusal. If, after such notice to EPA, said Resident continues to refuse to relocate, then all of Nepera's obligations with respect to that Resident, including, but not limited to, any obligation to provide temporary housing, shall cease. Nepera shall not be required to force Residents to move from the Site. Even if a Resident refuses to move from the Site, Nepera shall not be construed to be in violation of this Work Plan or the Agreement.
10. Nepera shall pay for the preliminary bio-monitoring screens (urinalysis for mercury) for the sixteen (16) Residents of the Site which the NYSDOH conducted during the week of 10/24/94.

400023

Mercury Trailer Site  
NYSDOH Site # 336821N  
(V) Harriman, Orange County  
8-9-94  
Mark E. VanValkenburg  
NYSDOH

\*1701 100023

x - sample locations (four total)  
H - fire hydrant



UPHILL

Lee property

large garden

residence of John C. Lee, Jr.

abandoned well

garage

tree line: property line

(170) #4 x telephone pole

Shed

Auto Transmission Garage

pile

recent excavations

recent excavations

waterline

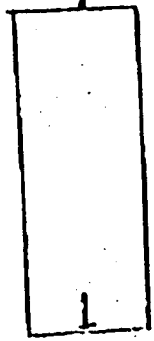
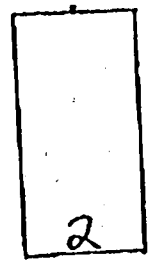
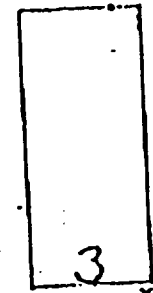
pile

(110) x #3B

(320) #3W

(230) #5

Shed



WETLANDS

driveway

sanitary sewer

Rt. 71 - Harriman Heights Road

Sunoco Gas

Restaurant

Rt. 17M - Ramapo Ave.

Chemical Bank

Longwoodbury  
Van Hook  
Fire SS

Marina Pizza Restaurant

NYSDEC FINAL LAB RESULTS  
received 8-1-94 (ppm mercury)

# HEALTH CONSULTATION

## **PYRIDIDIUM MERCURY DISPOSAL SITE #1**

**Orange County**

**Harriman, New York**

**CERCLIS NO. NY0000856237**

**August 28, 1995**

---

**Prepared By**

**New York State Department of Health**

**Under Cooperative Agreement With**

**U.S. Department of Health & Human Services**

**Public Health Service**

**Agency for Toxic Substances and Disease Registry**

**HEALTH CONSULTATION**

**PYRIDIUM MERCURY DISPOSAL SITE #1  
HARRIMAN, ORANGE COUNTY, NEW YORK  
CERCLIS NO. NY0000856237**

**August 28, 1995**

**Prepared by:**

**New York State Department of Health  
Under a Cooperative Agreement with the  
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## BACKGROUND AND STATEMENT OF ISSUES

The New York State Department of Health (NYS DOH) through a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR) has reviewed information and analytical data from the Pyridium Mercury Disposal Site #1 to determine if there is a public health threat associated with exposure to mercury. The Pyridium Mercury Disposal Site #1 (Figure 1, Appendix A) is in the Village of Harriman, Town of Monroe, Orange County, near the corner of Routes 17M (Ramapo Avenue) and 71 (Harriman Heights Road). The area of concern (Figures 2A and 2B, Appendix A), which is about one acre in size, includes five, single-family trailer homes. The site, on record as the McGill Trailer Park, is under permit from the Orange County Health Department as a regulated mobile home park. The property is bounded to the northwest by an auto transmission shop, to the southwest by a residential lawn, to the southeast by wetlands and to the northeast by Route 17M. The five trailers are occupied by sixteen residents, including an expectant (12/94) mother and her four year old son. Three of those sixteen residents, a mother and her two teenage sons, moved in with a current resident well after the wastes had been identified and residents warned. Of the nine parents and seven children living on-site, the children's ages are 4, 14, 16, 17, 20, 28 and 31. Young grandchildren are known to visit. According to a local resident, the waste materials, a mercuric or mercurous salt generated during the production of niacinamide (vitamin B-3) by the former Pyridium Corporation, were allegedly dumped during the late 1940's (1947-1948).

On August 8, 1994, the NYS DOH was notified of the potential health concern by the New York State Department of Environmental Conservation (NYS DEC). The NYS DEC forwarded recent correspondence from the property owner's attorney describing a white clay-like material (discovered behind the trailers) containing an elevated mercury level of 238 milligrams per kilogram (mg/kg). Mercury is typically found in soils at levels less than 1 mg/kg. In response, NYS DOH staff inspected the property on August 9, 1994. The suspected waste material was readily identified at the ground surface around trailers 3, 4 and 5. The easily distinguishable white waste material was observed in a sinkhole, between walkway steps, in a flower garden, beneath a trailer, in ant mounds, and underlying a few vegetable plants. Four surface (0-1 inch) soil/waste samples were collected and analyzed by the NYS DEC laboratory for total mercury. Mercury was detected at 110 mg/kg in a flower garden, 170 mg/kg in a sinkhole, 230 mg/kg behind a storage shed and 320 mg/kg between sidewalk steps. At the request of the NYS DOH and the ATSDR, the US Environmental Protection Agency (US EPA) later contracted for further laboratory analysis (i.e., speciation) of the wastes. The material was identified as inorganic mercury: a mercuric or mercurous salt.

Some of the residents interviewed by NYS DOH staff during the August 9 visit reportedly had contact with the waste material when gardening and digging fence post holes. One parent, who has lived on-site for about 25 years, said that while her children were growing up, they played with the clay-like waste as if it were modelling clay.

On August 11, 1994, NYS DEC staff collected additional environmental samples to determine if the waste materials could be classified as "hazardous waste" according to NYS DEC's legal definition. By NYS DEC's definition at that time, a mercury waste sample would be regarded as a "hazardous waste" if the Extraction Procedure Toxicity (EPTox) analysis of the sample detected a concentration of the metal at or above 200 micrograms per liter (mcg/L). The EPTox test is used to determine the likelihood that mercury will leach from the waste and contaminate groundwater. The EPTox test alone does not determine if a chemical concentration in soil or waste is a public health concern. Six soil/waste samples and one surface water sample were taken. EPTox results for mercury in the six soil/waste samples ranged from 0.1 mcg/L to 20.0 mcg/L, well below the NYS DEC action level. Total mercury analyses were also performed. Concentrations detected near the trailers were: 198 mg/kg in a sinkhole at 18 inches below grade; 230 mg/kg in the same sinkhole at 6 inches below grade; 396 mg/kg beneath trailer #3; and 653 mg/kg immediately next to trailer #3 beneath (1-4 inches) a three plant vegetable garden. Mercury was detected in the stone/soil driveway at 4.6 mg/kg and at 0.92 mg/kg in the bank of a stream running through the adjacent wetlands. Mercury was detected in a water sample from a culvert draining the wetlands at a level of 0.13 mcg/L.

On August 17 and 18, 1994, NYS DOH staff monitored indoor and outdoor air using a portable, instantaneous-reading mercury vapor analyzer (Jerome Model 411). Due to instrumentation problems, the data collected at that time are questionable and, therefore, could not be used to adequately evaluate air quality.

Residents rely on the Village of Harriman municipal water supply for drinking water. These wells are not close to this site. The village water is regularly monitored to ensure that it meets State drinking water standards for public supplies. The service connections from the watermain to the trailers likely pass through buried waste materials. Entry of contaminants into the buried water pipes is unlikely. Should there be a crack, break, breach, or compromise in the integrity of the waterline piping, positive pressure within the pipes would force water out rather than allow contaminants to seep in. A major break in a waterline would be readily noticed by residents through a loss of water at the tap and by discolored (i.e., dirty) water.

## DISCUSSION

Mercury is present at higher than normal levels in surface soil and surface wastes at the Pyridium Mercury Disposal site. Exposure to mercury in surface soil and surface waste may occur by accidental eating of soil and dust, eating of garden fruits and vegetables grown in contaminated soils, skin contact or breathing of mercury contaminated dust or vapor. Children generally eat greater amounts of soil and dust than adults. This is especially true for preschoolers because they tend to put their hands or fingers in their mouths or for children with pica (an unreasonable craving), in this case, for soil. Those children who repeatedly handle the waste material would have a high likelihood of ingesting the mercury waste which could stick to their hands. Mercury contaminated soil can also be tracked into the home on shoes and left on floors and surfaces where people could come in contact with it. Indirect exposure for an infant can occur from eating contaminated breast milk if the mother were exposed to mercury.

Long-term exposure to mercury can damage the kidneys, nervous system and developing fetus (baby). The most sensitive target organ for low-level inorganic mercury exposure appears to be the kidneys.

Health comparison values are used to assess if further evaluation of the soil is needed. Several factors are considered in the evaluation including soil ingestion rate, the size and age of the exposed individual, length of exposure and the health effects data. A health comparison value for mercury in soil is the mercury concentration in soil which would provide, by ingestion, a dose of mercury equal to the daily exposure below which adverse health effects are unlikely to occur. A contaminant at concentrations exceeding a health comparison value does not mean that either exposure to the contaminant or adverse health effects have occurred or will occur since a margin of safety is built into the value.

Health comparison values are developed assuming worst case exposure, i.e., the greatest possible exposure. Using soil ingestion rates for children with pica will overestimate soil ingestion rates for the general public.

Soil mercury concentrations identified at the site range from 110 to 653 parts per million (ppm). Table 1 (Appendix B) contains soil health comparison values for inorganic mercury. The soil mercury concentrations at the site exceed some of the health comparison values. Therefore, the soil concentrations of mercury at the Pyridium Mercury Waste Disposal Site #1 warrant further characterization and evaluation of exposure pathways and the potential for adverse health effects in individuals who may have been exposed to the waste materials.

A child with pica has the highest exposure and, based on the highest soil mercury concentration (653 ppm), is at high risk of having adverse kidney effects. Children without pica and adults are at minimal risk of having adverse kidney effects. Fruits and vegetables grown in contaminated soil are an additional source of exposure. Mercury levels are higher in plants grown in contaminated soil than in those grown in soil which is not contaminated. Eating such plants could contribute additional mercury to the diet.

On October 26, 1994, as recommended by the ATSDR's Health Activities Recommendation Panel, the NYS DOH conducted urine mercury screening of the residents living in the five mobile homes. A total of 14 individuals participated in the testing which involved the collection of first catch (first thing in the morning) urine samples. Analyses were performed by the NYS DOH Wadsworth Center for Laboratories and Research. All 14 of these people had urine mercury levels within the normal range, below 20 mcg/L. Two residents were not included in the testing because they moved away on their own and could not be located.

The residents' urine mercury screening results indicate exposure has not caused an increase in mercury levels in the body to levels of concern for adverse health effects. The soil mercury concentrations at the site provide a source for exposure which could produce health effects in individuals whose activities lead to greater contact with the waste material.

On May 5, 1995, the NYS DOH sent copies of this health consultation to known interested parties requesting concerns and comments on the report by June 16, 1995. The NYS DOH received two comments which are responded to in Appendix D.

### CONCLUSIONS

Based on the information reviewed, the NYS DOH in consultation with ATSDR concludes the following:

1. Based on ATSDR's present public health hazard category classification (Appendix C), the Pyridium Mercury Disposal Site #1 is a public health hazard because inorganic mercury occurs in soil at concentrations which may cause health effects. Residents, particularly preschool children who may eat or play with contaminated soil and residents eating plants grown in the contaminated soil, are at risk of kidney damage due to the mercury contamination at the Pyridium Mercury Disposal Site #1.
2. Based on interviews with residents, exposure to inorganic mercury has occurred by dermal contact.

3. The nature and extent of contamination at this site has not been completely characterized. Contamination other than inorganic mercury may be present within subsurface fill materials. Sampling should extend outward and downward and include groundwater.
4. Based on the results of the recent urine mercury screening, follow-up testing does not appear necessary at this time. The NYS DOH does not plan, at this time, to track previous site residents to conduct urine/mercury analysis since the urine/mercury levels of the current site residents (those most likely at risk of exposure) were within the normal range. In addition, it is unlikely that mercury would be detected above the normal range in persons exposed several months before the urinary mercury testing because mercury leaves the body over time.

#### RECOMMENDATIONS

1. Measures should be taken to prevent exposures to yard soils which contain the mercury wastes. Dissociate (i.e., remove) all the residents, especially the expectant mother and her young child, from the wastes to prevent exposures that could damage their kidneys or neurological systems.
2. To evaluate exposure to mercury in the homes, dust samples should be collected within the trailers.
3. Completely characterize the nature and extent of contamination at the site. A comprehensive analysis of the wastes should be performed. Sampling of soils, wastes, and groundwater should extend outward and downward to determine areas requiring future remedial actions. Subsurface investigations might potentially identify other types of chemical wastes used as fill, or find buried drums, or detect groundwater contamination.
4. The company or agency that performs the additional environmental sampling should work with the NYS DOH so that sampling design and detection levels are appropriate to base further public health decisions upon.
5. Impose deed restrictions on the property, in the absence of waste removal, to prevent possible disturbance and contact with buried wastes.

#### HEALTH ACTIVITIES RECOMMENDATION PANEL RECOMMENDATIONS

The data and information developed in the Health Consultation for the Pyridium Mercury Disposal Site #1, Harriman, New York, has been

reviewed by ATSDR's Health Activities Recommendation Panel (HARP) to determine appropriate follow-up health actions. Because of past and current exposure to mercury-contaminated residential soils, the panel recommended this site for follow-up health activities. Specifically, those persons exposed should have urine samples collected and analyzed for the presence of mercury. In addition, the HARP also determined that community health and health professions education are indicated. The NYS DOH is currently conducting site-specific education activities at the site. Other health activities may be needed as more information about actual exposures and the nature of the waste materials are determined.

### **PUBLIC HEALTH ACTIONS**

#### Public Health Actions Taken

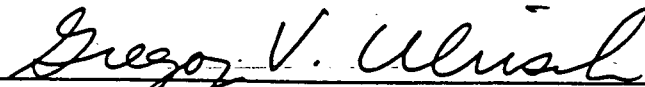
1. The NYS DOH has held two public meetings and a public availability session since August 1994 to provide information to the community about the site and to address health-related concerns.
2. The NYS DOH collected urine samples from the 14 residents currently living on-site. The samples were analyzed for mercury by the NYS DOH Wadsworth Center for Laboratories and Research. All 14 of these people had urine mercury levels within the normal range, below 20 mcg/L. All individuals and their physicians were provided with a copy and explanation of the urine sample results.
3. The site residents' physicians were provided with educational materials regarding the toxic effects associated with exposure to mercury.
4. NYS DOH physicians talked to several members of the community, on an individual basis, about health concerns related to the site.
5. The residents moved off-site by March 1995. Residents have been financially compensated for relocation expenses by Nepera, Inc. who currently occupies the former Pyridium pharmaceutical facility.

#### Public Health Actions Planned

1. The NYS DOH will review all site-related investigation reports and health-related information and, if necessary, hold additional public meetings.
2. The NYS DOH will continue to investigate reports of the existence of other similar sites in the community.

## CERTIFICATION

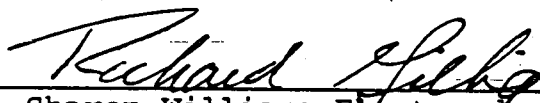
The Health Consultation for the Pyridium Mercury Disposal Site #1 was prepared by the New York State Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health consultation was initiated.



Gregory V. Ulirsch, M.S.  
Technical Project Officer

Superfund Site Assessment Branch (SSAB)  
Division of Health Assessment and Consultation (DHAC)  
ATSDR

The Division of Health Assessment and Consultation, ATSDR, has reviewed this health consultation, and concurs with its findings.



for Sharon Williams-Fleetwood, Ph.D.  
Chief, SSAB, DHAC, ATSDR

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Agency for Toxic Substances and Disease Registry (ATSDR). March 1992. Case Studies in Environmental Medicine, Mercury Toxicity. Atlanta, GA. U.S. Department of Health and Human Services.

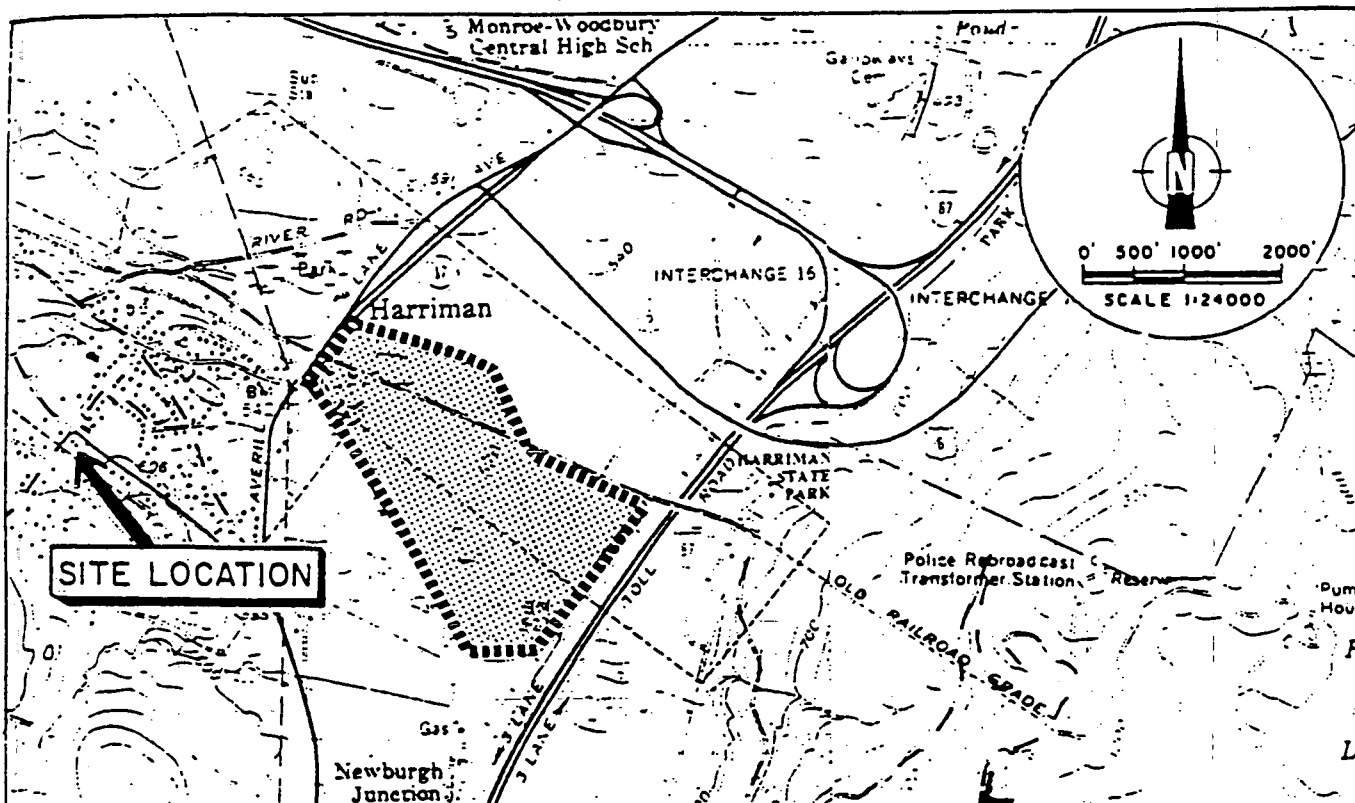
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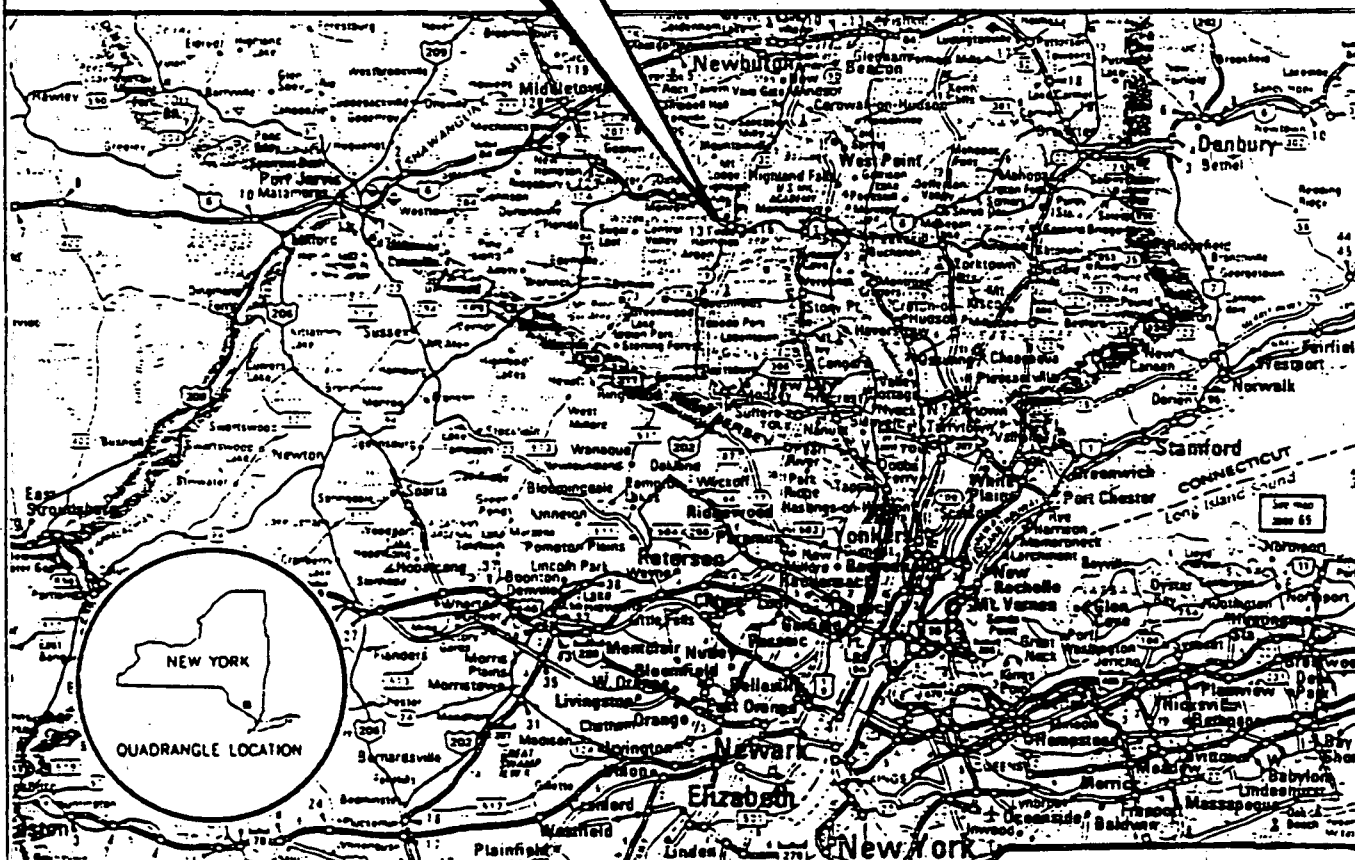
Conestoga-Rovers and Associates (CRA). 1992. Remedial Investigation Plant Site (Nepera, Inc.), Harriman, NY. Waterloo, Ontario, Canada.

World Health Organization (WHO). 1990. Environmental Health Criteria 101. Geneva, Switzerland. World Health Organization Distribution and Sales Service. International Programme on Chemical Safety.

**APPENDIX A****Figures**



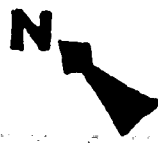
SOURCE: U.S.G.S. MONROE, N.Y. AND POPOLOPEN LAKE QUADRANGLE  
41074 - C2 - TF-024 AND N4115 - W 7400 / 7.5



SOURCE: RAND McNALLY ROAD ATLAS

figure 1  
SITE LOCATION  
HARRIMAN, NEW YORK

Mercury Trailer Site  
 (V) Harriman, Orange County  
 8-9-94  
 Mark E. Van Valkenburg  
 NYSDOH



X - sample locations (four total)  
 H - fire hydrant

\* NOT TO SCALE \*

UPHILL

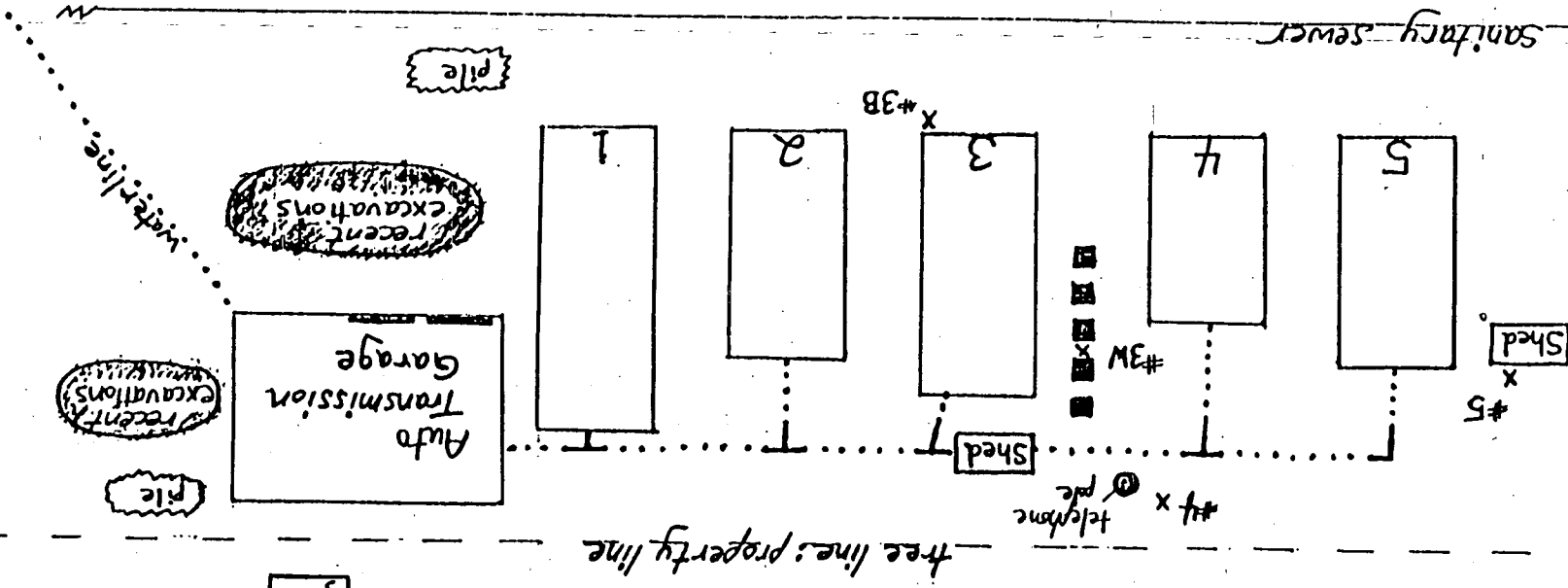
free property

12

WETLANDS

driveway

sanitary sewer



Rt. 17M - Ramapo Ave.

Chemical Bank

Marina Pizza Restaurant

Monroe/Woodbury Health and Fitness

Restaurant

Rt. 71 - Harriman Heights Road

14

Sunoco Gasoline

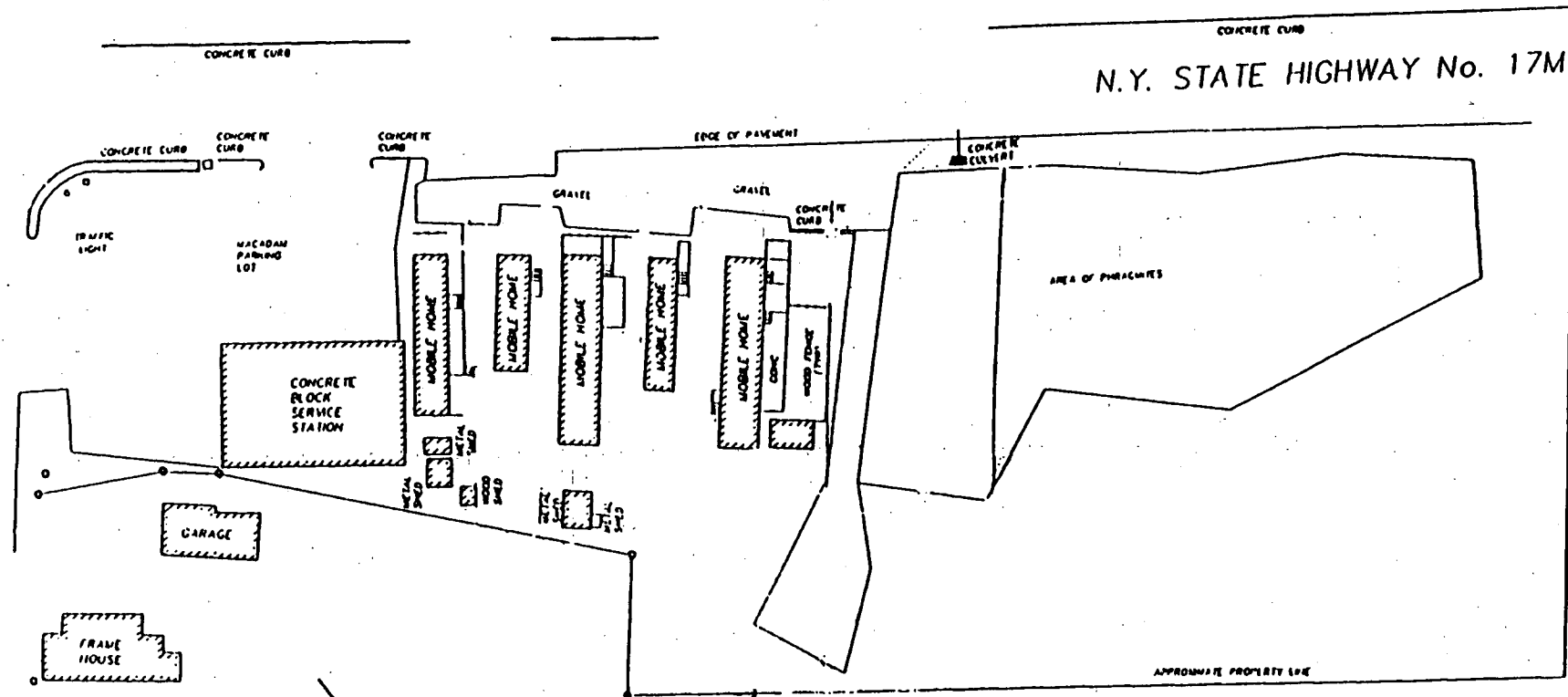


FIGURE 2B LOCATION MAP  
PYRIDIUM MERCURY DISPOSAL SITE NO. 1  
HARRINAH, NEW YORK

Scale 1" = 40'

**APPENDIX B****Tables**

Table 1. SOIL COMPARISON VALUES FOR RESIDENTIAL EXPOSURE  
TO INORGANIC MERCURY

Duration of Exposure:	COMPARISON VALUE				
	Ingestion of Soil			Soil and Homegrown Produce***	
	Pica Child <sup>1</sup>	Child <sup>2</sup>	Adult <sup>3</sup>	Child <sup>2</sup>	Adult <sup>3</sup>
Short-term*	14 ppm	--	9800 ppm		
Long-term**	0.6 ppm	47 ppm	420 ppm	1.5 ppm	4.9 ppm

<sup>1</sup>Assumes child with pica weighs 10 kg and ingests 5000 milligrams (mg) of soil per day.

<sup>2</sup>Assumes a 13.2 kg child, and a time-weighted-average soil ingestion of 85.2 mg soil per day to account for weekly and seasonal variability when estimating chronic exposures.

<sup>3</sup>Assumes an adult weighs 70 kg and ingests 50 mg of soil per day.

\*ATSDR has established short-term level (acute-oral Minimal Risk Level) for inorganic mercury of 0.007 milligram per kilogram per day (mg/kg/day). It is a level of short-term exposure to inorganic mercury below which adverse health effects are unlikely to occur.

\*\*US EPA has established a long-term level (chronic Reference Dose) for inorganic mercury of 0.0003 mg/kg/day. It is a level of long-term exposure to inorganic mercury below which adverse health effects are unlikely to occur.

\*\*\*Assumes 40% consumption of homegrown fruits and vegetables.

**APPENDIX C****Public Health Hazard Categories**





# **Public Health Assessment Guidance Manual**

**March 1992**



**U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES  
Public Health Service  
Agency for Toxic Substances and Disease Registry  
Atlanta, Georgia 30333**

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Table 8.1. Criteria and Actions for Levels of Public Health Hazard

<b>CATEGORY A</b> <b>URGENT PUBLIC HEALTH HAZARD</b>	<b>CATEGORY B</b> <b>PUBLIC HEALTH HAZARD</b>
<p><i>This category is used for sites that pose an urgent public health hazard as the result of short-term exposures to hazardous substances.</i></p>	<p><i>This category is used for sites that pose a public health hazard as the result of long-term exposures to hazardous substances.</i></p>
<p><b>Criteria:</b></p> <p>Evidence exists that exposures have occurred, are occurring, or are likely to occur in the future;</p> <p style="text-align: center;">and</p> <p>the estimated exposures are to a substance or substances at concentrations in the environment that, upon short-term exposures (less than 1 year), can cause adverse health effects to any segment of the receptor population. The adverse health effect can be the result of either carcinogenic or noncarcinogenic toxicity from a chemical exposure. For a noncarcinogenic toxic effect, the exposure exceeds an acute or intermediate minimal risk level (MRL) established in the ATSDR Toxicological Profiles or other comparable value;</p> <p style="text-align: center;">and/or</p> <p>community-specific health outcome data indicate that the site has had an adverse impact on human health that requires rapid intervention;</p> <p style="text-align: center;">and/or</p> <p>physical hazards at the site pose an imminent risk of physical injury.</p>	<p><b>Criteria:</b></p> <p>Evidence exists that exposures have occurred, are occurring, or are likely to occur in the future;</p> <p style="text-align: center;">and</p> <p>the estimated exposures are to a substance or substances at concentrations in the environment that, upon long-term exposures (greater than 1 year), can cause adverse health effects to any segment of the receptor population. The adverse health effect can be the result of either carcinogenic or noncarcinogenic toxicity from a chemical exposure. For a noncarcinogenic toxic effect, the exposure exceeds a chronic MRL established in the ATSDR Toxicological Profiles or other comparable value;</p> <p style="text-align: center;">and/or</p> <p>community-specific health outcome data indicate that the site has had an adverse impact on human health that requires intervention.</p>
<p><b>ATSDR Actions:</b></p> <p>ATSDR will expeditiously issue a health advisory that includes recommendations to mitigate the health risks posed by the site. The recommendations issued in the health advisory and/or health assessment should be consistent with the degree of hazard and temporal concerns posed by exposures to hazardous substances at the site.</p> <p>Based on the degree of hazard posed by the site and the presence of sufficiently defined current, past, or future completed exposure pathways, the following public health actions can be recommended:</p> <ul style="list-style-type: none"> <li>• biologic indicators of exposure study;</li> <li>• biomedical testing;</li> <li>• case study;</li> <li>• disease and symptom prevalence study;</li> </ul>	<p><b>ATSDR Actions:</b></p> <p>ATSDR will make recommendations in the health assessment to mitigate the health risks posed by the site. The recommendations issued in the health assessment should be consistent with the degree of hazard and temporal concerns posed by exposures to hazardous substances at the site.</p> <p>Based on the degree of hazard posed by the site and the presence of sufficiently defined current, past, or future completed exposure pathways, the following public health actions can be recommended:</p> <ul style="list-style-type: none"> <li>• biologic indicators of exposure study;</li> <li>• biomedical testing;</li> <li>• case study;</li> <li>• disease and symptom prevalence study;</li> <li>• community health investigation;</li> </ul>
<p>(Continued on next page)</p>	<p>(Continued on next page)</p>

Table 8.1. Continued

<b>CATEGORY A URGENT PUBLIC HEALTH HAZARD (continued)</b>	<b>CATEGORY B PUBLIC HEALTH HAZARD (continued)</b>
<ul style="list-style-type: none"><li>• community health investigation;</li><li>• registries;</li><li>• site-specific surveillance;</li><li>• voluntary residents tracking system;</li><li>• cluster investigation;</li><li>• health statistics review;</li><li>• health professional education;</li><li>• community health education; and/or</li><li>• substance-specific applied research.</li></ul>	<ul style="list-style-type: none"><li>• registries;</li><li>• site-specific surveillance;</li><li>• voluntary residents tracking system;</li><li>• cluster investigation;</li><li>• health statistics review;</li><li>• health professional education;</li><li>• community health education; and/or</li><li>• substance-specific applied research.</li></ul>

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Table 8.1. Continued

<p align="center"><b>CATEGORY C</b> <b>INDETERMINATE PUBLIC HEALTH</b> <b>HAZARD</b></p>	<p align="center"><b>CATEGORY D</b> <b>NO APPARENT PUBLIC HEALTH HAZARD</b></p>
<p><i>This category is used for sites with incomplete information.</i></p>	<p><i>This category is used for sites where human exposure to contaminated media is occurring or has occurred in the past, but the exposure is below a level of health hazard.</i></p>
<p><b>Criteria:</b></p>	<p><b>Criteria:</b></p>
<p>The limited available data do not indicate that humans are being or have been exposed to levels of contamination that would be expected to cause adverse health effects. However, data or information are not available for all environmental media to which humans may be exposed;</p>	<p>Exposures do not exceed an ATSDR chronic MRL or other comparable value;</p>
<p align="center">and</p>	<p align="center">and</p>
<p>there are insufficient or no community-specific health outcome data to indicate that the site has had an adverse impact on human health.</p>	<p>data are available for all environmental media to which humans are being exposed;</p>
<p align="center">and</p>	<p align="center">and</p>
<p>there are insufficient or no community-specific health outcome data to indicate that the site has had an adverse impact on human health.</p>	<p>there are no community-specific health outcome data to indicate that the site has had an adverse impact on human health.</p>
<p><b>ATSDR Actions:</b></p>	<p><b>ATSDR Actions:</b></p>
<p>ATSDR will make recommendations in the health assessment to identify the data or information needed to adequately assess the public health risks posed by the site.</p>	<p>If appropriate, ATSDR will make recommendations for monitoring or other removal and/or remedial actions needed to ensure that humans are not exposed to significant concentrations of hazardous substances in the future.</p>
<p>Public health actions recommended in this category will depend on the hazard potential of the site, specifically as it relates to the potential for human exposure of public health concern.</p>	<p>The following health actions, which may be recommended in this category, are based on information indicating that no human exposure is occurring or has occurred in the past to hazardous substances at levels of public health concern. The following health actions are recommended for sites in this category:</p>
<p>If the potential for exposure is high, initial health actions aimed at determining the population with the greatest risk of exposure can be recommended. Such health actions include:</p>	<ul style="list-style-type: none"> <li>• community health education;</li> <li>• health professional education;</li> <li>• community health investigation; and</li> <li>• voluntary residents tracking system.</li> </ul>
<ul style="list-style-type: none"> <li>• community health investigation;</li> <li>• health statistics review;</li> <li>• cluster investigation; and</li> <li>• symptom and disease prevalence study.</li> </ul>	<p>However, if data become available suggesting that human exposure to hazardous substances at levels of public health concern is occurring, or has occurred in the past, ATSDR will reevaluate the need for any followup.</p>
<p>If the population of concern can be determined through these or other actions, any of the remaining follow-up health activities listed under categories A and B may be recommended.</p>	
<p>In addition, if data become available suggesting that human exposure to hazardous substances at levels of public health concern is occurring or has occurred in the past, ATSDR will reevaluate the need for any followup.</p>	

Table 8.1. Continued

**CATEGORY E  
NO PUBLIC HEALTH HAZARD**

*This category is used for sites that do not pose a public health hazard.*

**Criteria:**

There is no evidence of current or past human exposure to contaminated media;

and

future exposures to contaminated media are not likely to occur;

and

there are no community-specific health outcome data to indicate that the site has had an adverse impact on human health.

**ATSDR Actions:**

No public health actions are recommended at this time because no human exposure is occurring, has occurred in the past, or is likely to occur in the future that may be of public health concern.

**APPENDIX D****Response to Public Comments**

Pyridium Mercury Disposal Site #1  
Response to Public Comments

This response to public comments was prepared to answer the public's comments on the Pyridium Mercury Disposal Site #1 draft Health Consultation. The public was invited to comment during the public comment period of May 5, 1995 to June 16, 1995. Two reply forms were received by the NYS DOH. If you have any questions about the response to public comments for the Pyridium Mercury Disposal Site #1, contact the NYS DOH, Health Liaison Program at the toll free number, 1-800-458-1158, extension 402.

Comment #1

One resident simply thanked us for the document and expressed feelings of reassurance from the results of the investigation.

Comment #2

A nearby resident expressed concerns that the contamination may have moved from the site to nearby properties. Staff responded to the resident by telephone and a visit to the resident's property.

The following information was provided to the resident during a telephone conversation on June 20, 1995

Staff explained that the agencies believe the contaminated fill material below the former trailer park ends at the edge of the adjacent wetlands and therefore we do not expect neighbors to be exposed to the waste material as long as they stay off the trailer park site. We determined the extent of contamination by soil sampling. The US EPA fenced the site to prevent trespassing and accidental contact with contaminants.

Surface water runoff from rainfall and snowmelt drains to the adjacent wetland. This water then flows out of the immediate area through a drainage pipe crossing under Route 17M. Any surface water leaving the site would enter the drainage pipe before ever reaching the nearby properties on the opposite side of the wetland. In addition, test results of one soil sample and one water sample collected within the wetland by the NYS DEC showed only very low levels of mercury that are not of public health concern.

As a follow-up to the telephone conversation, staff visited the residence on June 29, 1995, to look for visual evidence of surface wastes. We did not observe any waste materials. NYS DOH staff visited the same location in the fall of 1994 at the request of another tenant. At that time, staff dug into the garden soils looking for wastes and did not find any. We have no evidence that the soils at this nearby property are contaminated with Pyridium-like waste.